Vehicle Maintenance Safety

A Guide for the Air Force Vehicle Maintainer

Acknowledgments

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Foreword

Chances are you know someone who's been seriously injured or killed in a mishap that could have been prevented. The personal and professional impact of such a tragedy cannot be expressed by words. Every member of our Air Force, whether in uniform, a civil servant, or one of our supporting contractors, is an essential part of our team. Any injury or loss of life is unacceptable, and through the leadership of each and every one of us, we can prevent them in the future.

The genesis for this handbook occurred during a 2-week period in April 2002 when two vehicle maintenance mechanics died in preventable on-duty mishaps. These hard-charging NCOs, in the act of performing maintenance activities in support of the mission, made questionable, seemingly minor, decisions that ultimately resulted in their death. This handbook is one result of follow-on reviews of circumstances surrounding these accidents and was developed by your peers in vehicle maintenance to provide a quick reference that can be kept in your toolbox or pocket. The guidance in the Handbook does not add to, or replace, any existing policy or guidance; it simply focuses on vehicle maintenance hazards and provides a place where you can easily go for more information.

This handbook was also designed to help enhance your knowledge of Operational Risk Management (ORM) and integrate it into your daily activities. It is a valuable tool in helping you identify and avoid unnecessary risks.

> ORM gives airmen at every level a sound, mission-enabling tool to expand our expeditionary capabilities. It's time to make ORM the natural way for Air Force people to conduct their professional and personal activities.
>
> **—CSAF, July 2002**

Your job as a vehicle mechanic requires you to make potentially dangerous decisions daily. These decisions directly impact your coworkers, your unit, the Air Force mission, and most important, you and your family. Consider the consequences of someone within your work center being severely injured: do you have an *extra* mechanic to replace him or her? Does their family have an *extra* son, daughter, father, mother or spouse? Use this handbook to make informed decisions before you place yourself at risk. Call a timeout when you feel that you or your coworkers are going to accept unnecessary risks—and don't take those risks.

Safety is a top Air Force operational concern that involves every Air Force member. Maximize mission effectiveness and sustain the readiness of our expeditionary air force: use this handbook and make safety your top priority!

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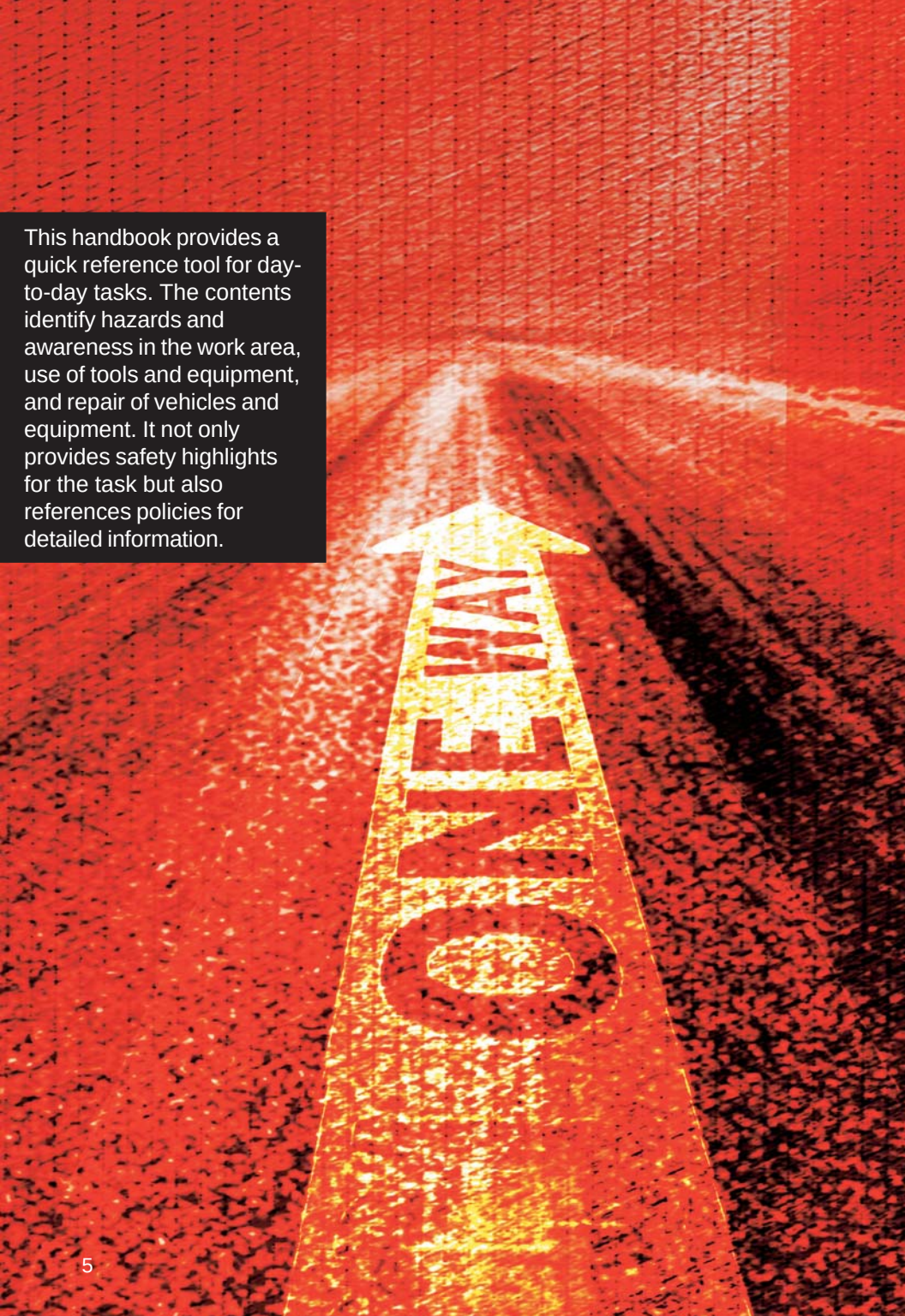


This handbook provides a quick reference tool for day-to-day tasks. The contents identify hazards and awareness in the work area, use of tools and equipment, and repair of vehicles and equipment. It not only provides safety highlights for the task but also references policies for detailed information.

Introduction

The Army first implemented operational risk management (ORM) in 1987. The Air Force adopted a similar program in 1996, and Air Force Policy Directive 90-9 outlines its ORM basic principles:

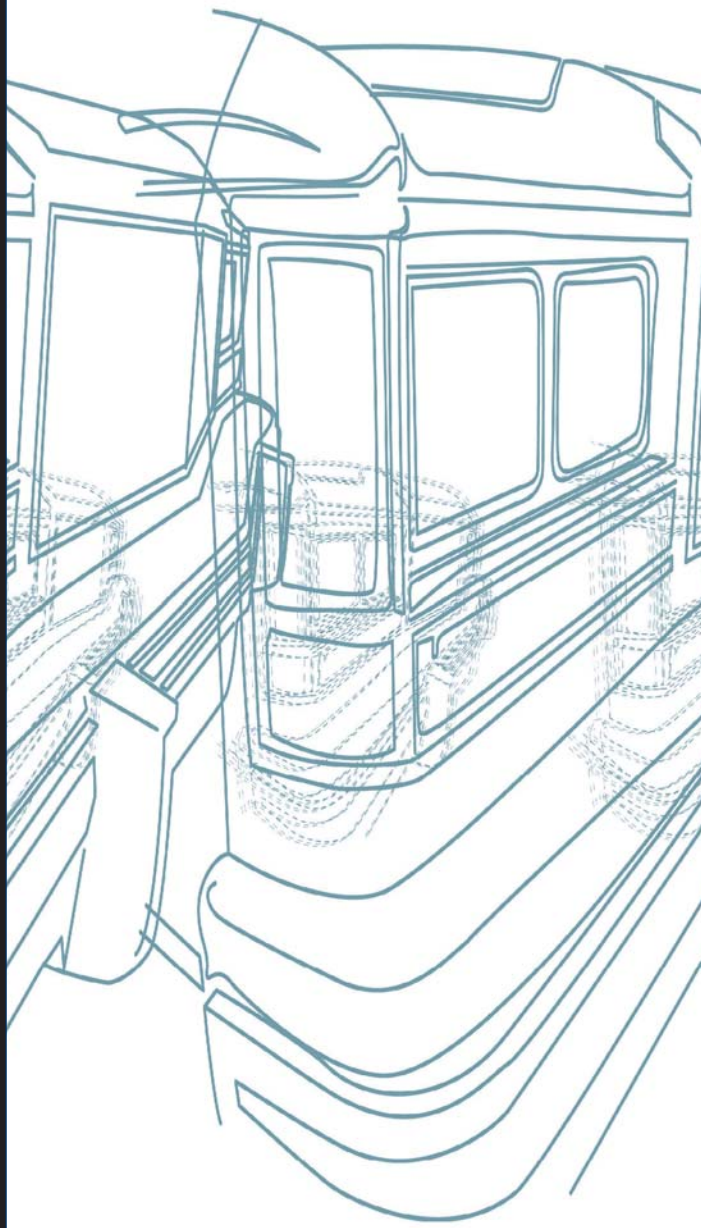
- Accept no unnecessary risk.
- Make risk decisions at the appropriate level.
- Accept risk when benefits outweigh costs.
- Integrate ORM into operations and planning at all levels.

To support these principles, the Air Force applies ORM during all aspects of preparation (planning, organizing, training, equipping, and sustaining) and employment of aerospace forces.

Within vehicle maintenance, several references (technical orders [TO], Air Force Safety Occupational Safety and Health [AFOSH], National Institute for Occupational Safety and Health [NIOSH], Air Force manuals [AFMAN], and industry) address safety issues. Because of the vast number of references, it is difficult to be familiar with all sources. While self-inspection checklists help identify some of the safety concerns, they do not cover all issues, concerns, and requirements. Because of recent mishaps, this handbook was designed to be a quick reference tool for day-to-day tasks. The contents identify hazards and awareness in the work area, use of tools and equipment, and repair of vehicles and equipment. It not only provides safety highlights for the task but also references policies for detailed information.

Use of this book should help the organization and individual effectively manage risks, thus maximizing mission effectiveness and sustainment of readiness.

Chapter 1
Operational Risk Management



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Risk management is a continuous process; do not make ORM hard. Consider the following simple process for all daily tasks.

ORM Process

📖 Refer to Air Force Pamphlet (AFPAM) 90-902

Basic Risk Management Process

Step 1—Identify hazards
- Do you know what is involved or required from start to finish?
- What can cause things to go wrong?
- Is there a better way?

Step 2—Assess risk
- If one, or more, of the hazards happens, how bad is it?
- How likely is it to happen?

Step 3—Analyze risk control measures
- What can you do about it?
- What are your options?
- How much will it improve things?

Step 4—Make control decisions
- What are the best choices?
- Who decides which choices to use?
- It is time for decisionmakers to make decisions.

Step 5—Implement risk controls
- What do you need to make it work?
- Who is doing each part?

Step 6—Supervise and review
- How well did it work?
- What improvements are needed?
- Who else needs to know?
- Apply the **ORM six-step process** to all tasks.
- Do not use a complicated solution if a simple one will work.
- When in doubt, remember the basic ORM six-step process.

*ORM has universal application and begins with **you.** It is not new, but like everything else, it does take practice.*

Apply the ORM 6-step process.

DO NOT use a complicated solution if a simple one works.

Keep your ORM process simple so you can use it!

Bottom line: if it is not worth the risk, do not do it!

Vehicle Maintenance-Related Task

To illustrate how ORM works, take a look at the task of repairing a flat tire.

Step 1—Identify the hazard (AFPAM 90-902, Section C, Step 1).

- Vehicle jack—potential for vehicle to fall off jack
- Pneumatic tools—high-decibel noise and potential flying debris
- Tire machine—potential injuries (pinching and cutting)

Step 2—Assess the risk (AFPAM 90-902, Section D, Step 2).

Step 3—Analyze risk control measures (Eliminating one of the three components of risk: probability, severity, and exposure) (AFPAM 90-902; Section E, Step 3).

Risk	Vehicle Jacking	Pneumatic Tools	Tire Machine
Severity	Critical	Critical	Critical
Probability	Occasional	Likely	Occasional
Risk Level	High	High	High

Table 1. Assessing the Risk

- Appropriate vehicle jack stands reduce probability of and exposure to injury.
- Appropriate hearing and eye protection reduces probability and exposure to sight or hearing hazards.

- Appropriate hearing and eye protection reduces **probability** and **exposure** to hearing and sight loss.

Step 4—Make control decisions (AFPAM 90-902, Section F, Step 4). Using the above plan is acceptable, and probability and exposure to injury will be reduced or eliminated.

Step 5—Implement risk controls (supervisory responsibility) (AFPAM 90-902, Section G, Step 5).
- Personal protective equipment (PPE) must be provided.
- Ensure technicians are aware of risk management process results and risk control decisions.
- Document risk management process when necessary.

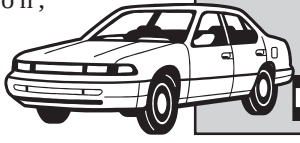
Step 6—Supervise and review (AFPAM 90-902, Section H, Step 6).

Supervisor must:
- Strive to make risk management process second nature,
- Monitor the operation periodically to ensure the controls are in place and still effective,
- Perform a cost-benefit review to ensure risk and costs are in balance, and
- Have a feedback system soliciting inputs to determine effectiveness of controls.

Deployed Operations

While the same ORM tools are used at both home and deployed stations, this section was developed to show some of the limitations and challenges that will affect you, your unit, and your processes during an air expeditionary force deployment cycle. Historically, efforts have been focused on the deployment portion, when, in fact, similar hazards may increase at both the deployed and home locations.

Supervisors must strive to make the risk management process second nature, monitor the operation periodically, perform a cost-benefit review, and have a feedback system.



Maintenance Safety

Deployed Site

- Vehicle maintenance resources may be limited.
  - Tools and equipment
  - Technical orders and manuals
  - Facilities
  - Personnel
- Lean number of assigned mechanics at deployed location.
  - May be the only mechanic assigned.
  - Will be considered the vehicle *expert* at small locations.
- Operations tempo is high.
  - Extended work shifts, 12+ hours.
  - Six- to seven-day workweek.
  - Successful mission accomplishment is dependent on repair of vehicle.
    - Tendency to *cut corners.*
    - Parts and supply availability may be limited—tendency to *rig* or make parts work to get by.
    - Leasing and recall of vehicles may not be options.

Vehicle maintenance resources may be limited, with few assigned mechanics and a high operations tempo.

Home Station

- Remaining personnel.
  - Supervisor's span of control is widened. May be forced to supervise unfamiliar work centers.
  - Experience level is low.
  - Training is sometimes curtailed.
  - Extended work shifts, 12+ hours. Mechanics are detailed to support other wing requirements.
- Day-to-day operations at bases may continue at predeployment levels.

Ensure Safety

- **Accept no unnecessary risk.** Accomplishment of mission ensures personnel and resources are exposed to the lowest acceptable risk.
- **Make risk decisions at the appropriate level.** Those accountable for success or failure of the mission must be included in the risk decision process.

- **Accept risk when benefits outweigh costs.**
  - Benefits should be compared with all potential costs.
  - Weighing risks against opportunities and benefits helps maximize unit capability.
  - High-risk endeavors may be undertaken when it is believed the sum of the benefits exceeds the sum of the costs.
- **Integrate ORM into operations and planning at all levels.** Risks are more easily assessed and managed in the planning stages of an operation.

Accept no unnecessary risk, make risk decisions at appropriate level, accept risk when benefits outweigh costs, and integrate ORM into operations and planning.

Chapter 2
Individual Responsibility

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It takes both you and your supervisor to ensure you have a safe working environment.

Basic Responsibilities

📖 Refer to AFOSH Standard (AFOSHSTD) 91-501, Chap 2.

You are responsible for:

- **Your** personal safety and well-being;
- Complying with technical orders, operating instructions, and regulations;
- Reporting or correcting hazardous conditions or seeking guidance;
- Proper use and serviceability of PPE; and
- Notifying your supervisor or chain of command of any injury or health condition affecting your job.

Stop if you believe an act is unsafe.

DO NOT assume someone else already reported the hazard.

DO NOT assume someone is watching out for you.

DO NOT accept unnecessary risk.

DO NOT work in a shop by yourself.

Your supervisor is responsible for:

- Documenting Air Force Form 55, *Employee Safety and Health Record*;
- Promptly responding to reported safety concerns or problems; and
- Using the job safety training outline to brief work center hazards, safety requirements, and safety references.

It takes both you and your supervisor to ensure you have a safe working environment.

Personal Protective Equipment

📖 Refer to AFOSHSTD 91-501, Chap 14.


Eye and face protection is required where there is a possibility of injury from flying particles, splatters, or chips.

Ear protection is required when there is a possibility of exposure to high noise levels.

Foot protection will be worn when performing maintenance.

Hand and arm protection is required for hazard exposure during chemical hazard exposure (skin absorption) and to avoid cuts, lacerations, abrasions, or punctures.


Respiratory protection is required when there are breathing hazards present; for example, hazardous dusts from painting, sanding, welding, and asbestos.

Housekeeping

📖 Refer to AFOSHSTD 91-501, Chap 5.

- **Shop floors** should be kept as clean and dry as possible to prevent accidental slips with or around dangerous handtools or electrical shock with power tools.
  - No spills
  - No tripping hazards
  - No clutter
  - No parts lying around
  - No tools on the floor
  - No puddles of water
- Inspect housekeeping and maintain a cleanliness standard to ensure an accident-free work environment.
- Good housekeeping will also eliminate potential sources of fire.
  - Empty trash daily.
  - Clean up spills immediately.
  - Oil soaked rags, absorbent pads (place in suitably marked closed container).

Vehicle Repairs

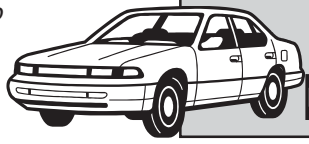
Two-Person Concept (Air Force Instruction [AFI] 24-302, para 2.14.10; AFMAN 24-307, para 1.39.42.5; AFOSHSTD 91-20, para 9.2.7.8)

Qualified to Operate

- Supervisors are responsible for ensuring **each technician** is qualified to *operate* all vehicles and equipment.
- Document training on Air Force Form 797, *Job Qualification Standard Continuation and Command*.

Many situations (refueling maintenance shop) require a two-person team, one tasked-qualified and an observer.

A vehicle operator may be used as a second person in lieu of a vehicle mechanic.



Maintenance Safety

***Shop use only* is no longer a valid annotation on Air Force Form 2293, Government Driver License; use Air Force Form 797 instead.**

- Use extra caution when operating unique, rarely operated, vehicles and equipment.
- Follow safety procedures outlined in technical orders and operating instructions.

Procedures to Report TO Deficiencies (TO 00-5-1, Chap 5)

- Air Force Technical Order (AFTO) Form 22, Technical Manual (TM) Change Recommendation and Reply, procedure:
  - AFTO Form 22 [Online] Available: http://www.e-publishing.af.mil/forms/speclist.asp?type=AFTO
  - Classify request as e*mergency*, u*rgent*, p*riority*, or *routine* report (TO 00-5-1, para 5-4).
  - Submit request via e-mail attachment to the MAJCOM TO manager.
- Joint Computer-Aided Acquisition and Logistics Support (JCALS) procedure: TO users with access to a JCALS terminal should use the "Recommend a TM Change process" (TO 00-5-1, 5-1).

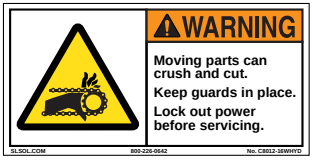
Dangers, Warnings, Cautions, and Notes

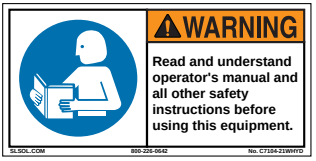
- Many technical manuals (commercial and military) have a safety summary at the beginning of the manual indicating general safety precautions, warnings, cautions, and notes.
- **Dangers, warnings,** and **cautions** precede the text to which each applies, but **notes** may precede or follow the applicable text.
- Prior to starting any task, workers **must** review and understand the DANGERS**,** WARNINGS, CAUTIONS, or NOTES included in the text for that task.

DANGER	Indicates an imminently hazardous situation, which, if not avoided, will result in death or serious injury. This is limited to the most extreme situations.
WARNING	Highlights an operation or maintenance procedure, practice, condition, or statement, which if not strictly observed, could result in injury or death.
CAUTION	Highlights an operation or maintenance procedure, practice, condition, or statement, which if not strictly observed, could result in damage to or destruction of equipment or loss of mission effectiveness.
NOTE	Highlights essential information, conditions, or procedures.

Vehicle Warning Labels and Signs

- The following are some examples of labels.
- Prior to performing any work, walk around the vehicle and familiarize yourself with them.





Air Force Form 55, Employee Safety and Health Record

- Used to document safety, fire prevention, and occupational health training and on-the-job training.
- Maintained by supervisor for all assigned personnel.
- Mandatory items to be briefed are in Section 1.
- Used to document initial and annual refresher training.
- Updated when a new task or hazard is introduced into the workplace.

Chapter 3
Work Center Hazards

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Only trained personnel should operate shop equipment. If you are in doubt, ask your supervisor before proceeding.

Manual Lifting

Maximum manual lifting weight (AFOSHSTD 91-20, para 1.2.13 and 91-501, Chap 4)

- 40 pounds for the average woman.
- 60 pounds for the average man.
- For weights greater than this, seek additional help or use mechanical devices.

The maximum lifting weight is 40 pounds for women and 60 pounds for men.

How to Lift Properly

- Prior to lifting:
  - Ensure path of travel is clear,
  - Inspect object for sharp edges or rough surfaces,
  - Inspect object for slippery surfaces,
  - Use leather gloves and safety-toe shoes, and
  - Keep hands and fingers away from shear and pinch points.
- Position feet correctly.
  - Shoulder width apart for balance.
  - One foot to the rear of the object.
  - Other foot slightly ahead of the other and to the side of the object.
- Crouch close to the load (preferred over squatting).
- Keep back as straight as possible (bend from the hips, not in the middle of the back).
- Pick up materials with a **full** palm grip (not fingertips).
- To lower the object, turn the whole body and crouch down.

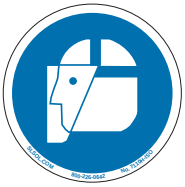
DO NOT carry a load that obstructs your front view.

DO NOT turn at the waist to change direction or to put an object down.

- Assign additional workers to assist when:
  - The load or material is too much for one person to handle safely or
  - Mechanical equipment is not practical for this purpose.
- Use additional workers who are:
  - Approximately the same size and
  - Trained in team-lifting techniques.

Grinding

- Eye protection is mandatory regardless of whether or not eye shields are installed.
- Ensure wheel is securely installed with no cracks, gouges, chipped edges, uneven wear, or evidence of side grinding.
- Visually inspect and perform a ring test in accordance with AFOSHSTD 91-501, para 18.6.2.5.1.3.
  - Tap wheels gently with a nonmetallic device.
  - Dull sound indicates there is a crack.



Remember your eye protection.

DO NOT grind soft metals on wheels not designed for these purposes.

- Ensure newly installed wheels run at operating speed for at least 1 minute prior to use.
- Ensure safety guards are installed and correctly adjusted.

Cracks are not always visible!

- Use only grinding wheels marked with a validated rpm rating.

- Adjust work rests with a maximum opening of one-eighth of an inch and peripheral protector (tongue guard) to one-quarter of an inch.
- Stand to one side when turning machine on.
- When using wire brush wheel, face shield and apron are required.

Cutting

Cutting with Machinery (AFOSHSTD 91-20 and 91-501, Chap 14 and 18)

- PPE and clothing will meet or exceed requirements.
- Ensure use of a self-adjusting guard device to prevent accident.
- Guard the working part of a saw blade to prevent accidental contact.
- Use work-holding devices (vises and fixtures).
- Safeguard must have enough strength to protect the operator in the event of a broken blade.

Cutting with a Torch (AFOSHSTD 91-5, 91-20, and 91-25)

- Cutting with a torch on concrete floors may cause concrete to spall and fly.
- Never cut gas tanks or drums without properly purging, ensuring there is no chemical activity present (inert).
- Fire-extinguishing equipment will be available and ready for use.
- Cutting with a torch has the potential to create a toxic, unhealthy atmosphere.
- Only vehicle maintenance activities that have been approved by the base fire department are allowed to cut with a torch.
- Confined space operations must be authorized and have adequate ventilation to prevent accumulation of toxic materials or possible oxygen deficiency.

General Welding Operations

📖 Before starting any welding procedure, refer to AFOSHSTD 91-5.

Hazards

- Extreme heat
- High-intensity light
- Harmful gases and vapors
- Fire or explosion potential
- Electrocution if not properly grounded

PPE Required

- Leather gloves
- Proper welding helmet
- Leather jacket and overalls
- Steel-toe boots

Be Aware of Your Surroundings

- Weld in approved areas only or obtain a welding permit.
- Are there combustible materials within 35 feet? If so, you will need a fire watch.
- Are flammable materials removed or properly shielded from the work area (AFOSH 91-5, para 2.3.2.4)?

DO NOT stand in water when welding.

- What is behind the area to be welded? Is it flammable or explosive? Can it be damaged from heat?

Hazardous Communication

- You have the right to know and fully understand the chemicals you work with.

Effects of overexposure to hazardous chemicals are not usually immediate but develop over time.

- Ensure a hazardous communication (HAZCOM) and respirator program is in place.
- An excellent source for developing a respirator program for your shop is [Online] Available: http://www.osha.gov/SLTC/respiratoryprotection/index.html
- Exposure to hazards can come from work areas such as:
  - Changing rooms
  - Laundry rooms
  - Lavatories
  - Offices

Painting

📖 Refer to AFOSHSTD 91-20, Chap 5.

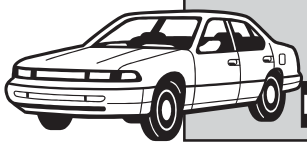
Diisocyanates

- Are highly reactive chemicals used in automotive paints, insulation materials, foams, and other products.
- Can cause serious or fatal respiratory disease.
- Are the leading cause of occupational asthma.
- Organic vapor cartridge respirators:
  - Do not provide air; they only filter contaminated air.
  - A supplied air respirator system must be used in oxygen deficient atmospheres.

Fit test of all pressure, tight-fitting face-piece respirators

- Required prior to initial use.
- Whenever a different respirator face piece is used.
- At least annually thereafter.

An additional fit test is required whenever changes occur in the user's physical condition that could affect respirator fit.



Proper PPE: respirator, coveralls, and gloves

- Limited-use, breathable coveralls with or without hood and booties
- Spray sock (hood that fully covers the head and neck but leaves face exposed)
- Nitrile gloves or leather gloves depending on the task at hand

Bioenvironmental and NIOSH-approved respirator with high-efficiency particulate air prefilters for best protection

Have you been properly trained to use the paint and equipment?

Is the equipment serviceable?

Do you have enough time to complete the job without getting in a rush?

Is someone aware that you will be painting?

Stay hydrated; be aware of possible dehydration while painting.

Pressure Washing

DO NOT point the gun at yourself or another person.

- Wear appropriate PPE, including face shield, gloves, and rubber apron.
- Can cause hazardous waste.

Batteries

DO NOT park running vehicles near shop compressors used to supply air for spray painter's fresh air masks (AFOSHSTD 91-20, para 5.2.10).

Batteries

📖 Refer to AFOSHSTD 91-66, para 1.3.

Protective Equipment

- Eye safety is mandatory anytime you are in contact with batteries.
- When handling acid, resistant aprons and gloves will be worn.
- When possible, work close to an eye washstation or have handheld water bottles available.

Charging

- A good examination of the battery will be accomplished before charging.
- Look for swelling; corrosion; warps; and most of all, cracks or leaks.
- Never attempt charging a frozen battery.
- Only add distilled, deionized, or approved water to the battery **(never top off with acid or a mixture of acid and water).**

Jump Starting

- Follow the specific vehicle technical orders or manuals.
- Stay clear of fan blades, fan belts, pulleys, and other moving engine parts when working near an engine.
- Position cables and clamps so they will not come in contact with any moving engine parts.

DO NOT place metallic objects on top of the battery.

Cleaning, Replacing, or Removing

- Always remove the negative cable first and install last.
- The top of the battery should be kept clean.
- Make sure vent caps are securely in place to prevent any solution from entering cells.

DO NOT smoke when working around batteries.

Slips, Trips, and Falls

📖 Refer to AFOSHSTD 91-20 and 91-501, Chap 7.

Walking and Working Surfaces

- Shop floors should be kept as clean and dry as possible to prevent accidental slips with or around dangerous handtools or electrical shock with power tools.
- A nonskid working surface should be available when maintenance is performed in ice or snow.
- Protruding hazards, such as forklift tines, should lie flat on the floor and be marked with cones or red flags.
- Extension cords and airhoses must be picked up from the floor when not in use.
- As a rule, try not to extend cords, hoses, or jack handles over walkways.
- Maintenance pits need to be roped off when not in use.
- When pit is in use, mark or cone off exposed areas to notify people of danger.
- Ensure ladders and scaffoldings are properly set up and in good condition.

Confined Spaces

📖 Refer to Occupational Safety and Health Administration (OSHA) Regulation (Standards-29 Code of Federal Regulations) 1910.146 and AFOSHSTD 48-137 and 91-25.

Serious injury or death in a confined space can be the result of asphyxiation, engulfment, electrical shock, fall, or heat stress. OSHA believes 85 percent of these accidents can be prevented if you learn about hazards on your job.

Hazards

- Personnel entering or working in a confined space may encounter atmospheric hazards.
  - Lack of oxygen to support life
  - Excessive oxygen levels that increase danger of fire or explosion
  - Presence of flammable or explosive gases and materials

Training

- Each organization will develop a structured and effective training program to establish safe work practices and techniques.
  - Lesson plans should be approved by base safety, civil engineering, and bioenvironmental agencies.
  - All confined space training will be certified, current, and documented on Air Force Form 55.

Chapter 4
Shop Awareness

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When working in the shop, be aware of electrical safety, ventilation, compressed gases, and structural hazards.

Electrical Safety

📖 Refer to AFOSHSTD 91-501, Chap 8.

Lighting

- Potential Hazards
  - Inadequate lighting
  - Tripping hazard from droplight cords
  - Lack of emergency lighting during night operations or power outages

Potential hazards are inadequate lighting, droplight cords, and a lack of emergency lights.

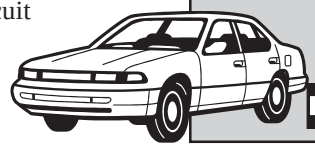
- Safety Requirements
  - At least 50-foot candles of illumination will be maintained at a worker's position.
  - Replace burned-out, intermittent, or broken bulbs.
  - Contact civil engineering when replacement of light bulbs exceeds capabilities of personnel and equipment.
- Lighting Fixtures
  - Light fixtures with nonself-locking fluorescent tubes must have shields, clamps, or other methods to secure tubes (AFOSHSTD 91-501, para 5.7).
  - Electrical cords and droplights will not be left on the floor when not in use.
  - Inspect cords for exposed wiring and ensure plug is not damaged.
  - Remove unserviceable cords until repaired or replaced.

- Exit signs will be suitably illuminated by emergency power as required by National Fire Protection Association Agency Standard 101.

Electrical

- Electrical Shock
  - Inspect electrical cords for:
    - Fraying,
    - Cuts,
    - Damage, and
    - Missing ground prong.
  - Inspect outlets and other electrical facility apparatus for damage.
  - Notify all shop personnel of the hazard.
    - If the equipment is hardwired to the building, notify supervisor and use lockout and tag-out procedures (discussed later in this chapter).
    - If the equipment is not hardwired, unplug it, notify supervisor, and utilize lockout and tag-out procedures (discussed later in this chapter).
  - Notify building custodian of an unsafe condition requiring civil engineering expertise.
  - Ensure circuit-breaker box location is known.
- Static Electricity
    - Can be an ignition source when working around flammable or combustible liquids.
    - Ensure you are properly grounded before using ladders and related equipment.
    - Ensure you are properly grounded when handling vehicle circuit boards and computers.

Static discharge plates will be provided during fuel cell repair or refueling vehicle maintenance operations (AFOSHSTD 91-501, para 7.5.2.10).



Maintenance Safety

Ventilation

📖 Refer to AFOSHTD 48-2 (being published) and AFOSHSTD 161-2 [Online] Available: https://www.afms.mil/occ_env/lframe.htm

Shop Ventilation

- Vehicle Exhaust.
  - Potential for carbon monoxide (CO) buildup exists any time a vehicle is operated in the shop.

  - Symptoms of early exposure to carbon monoxide include:
    - Increased breathing rate and
    - Becoming faint or nauseous
  - If symptoms persist, leave the area immediately and seek medical attention.
- Safety Requirements.
  - Utilize exhaust ventilation system.
  - Open overhead doors as needed.
  - Airflow will be adequate to provide fresh air and prevent accumulation of hydrocarbon vapors and carbon monoxide (AFOSHSTD 91-20, para 1.2.12.3).
  - Installation bioenvironmental engineering will monitor CO concentration. The supervisor will ensure a CO assessment is conducted annually (AFOSHSTD 91-20, para 1.2.3.1.1.1).
  - In-floor ventilation systems
    - Adapters will be used on equipment.
    - Units will be flush with the floor when closed.
    - Capable of withstanding vehicle and equipment traffic.

    - Equipped with a fluid collection system to prevent drainage into installation sanitary sewage systems.
  - Overhead ducting will be properly supported and afford adequate clearance to avoid damage from moving vehicles and equipment (AFOSHSTD 91-20, para. 1.2.3.1.1.2).
  - When not in use, ducting will be stowed appropriately preventing damage to equipment and hazards to personnel (AFOSHSTD 91-20, para. 1.2.3.1.1.3).

Battery Shop Ventilation (AFOSHSTD 91-66, para 1.3)

- Hydrogen Gas Hazard
  - When charging a battery, explosive gases are emitted.
  - Even with proper ventilation system, individuals must use caution to eliminate any potential ignition source.
- Safety Requirements
  - Ventilate battery shops or rooms to prevent an accumulation of gases.
  - Ignition sources are not allowed in battery charging rooms.

Wear all necessary protective equipment to prevent injury.

Paint Shop Ventilation

- Hazards
  - During painting, flammable and hazardous gases are released.
  - Exposure to airborne contaminates.
  - Flying debris; these could be grains of sand from sandpaper or paint particles.

  - If you become ill because of inhalation during paint operations, leave the area and seek medical attention at once.
  - Review Material Safety Data Sheet (MSDS) for recommended treatment.
- Safety Requirements
  - Painting is accomplished only in properly ventilated paint booths (AFOSHSTD 48-2 and OSHA 29 CFR 1910.107).
  - Respirators must be worn at all time.
  - Refer to MSDS for specific chemical hazards.

Welding Shop Ventilation

- Hazards
  - Inhalation of toxic fumes or vapors may occur from welding metals or alloys.
  - Some chemicals used in welding shop operations produce hazardous fumes.
  - If fumes or vapors are inhaled and the individual becomes ill, leave the area immediately.
  - Review MSDS for recommended treatment.
  - If illness persists, seek medical attention.

- Safety Requirements
  - Ventilation is required where work is to be performed.
  - Avoid strong drafts when welding.
  - Refer to MSDS for specific chemical hazards.
  - Consult with the installation bioenvironmental engineer on proper ventilation requirements (AFOSHSTD 91-5, para 3.18).

DO NOT use oxygen to provide ventilation (it accelerates combustion).

Compressed Gases

📖 Refer to AFOSHSTD 91-20, Chap 6.

Hazards

- Oxygen displacement
- Fires
- Explosions
- Toxic effects
- Physical hazards such as burns, blisters, and freezing of skin

Four of the more common gasses found in a maintenance shop are oxygen, acetylene, freon, and argon.

Safety Precautions

- Secure gas cylinders at all times.
- Cylinders will be placed with the main valve accessible at all times.
- Never attempt to repair a cylinder or valve.
- Regulators are gas-specific and not necessarily interchangeable.
- Store empty and full cylinders separately.
- Eye protection is required when handling and using compressed gases.
- Return all empty compressed gas cylinders, regardless of size, to supplier.
- Never store full or empty oxygen cylinders within 20 feet of flammable gases.
- When using oxygen cylinders, open valves all the way.

Caution should be taken when connecting or disconnecting lines.

- Never store flammable gas cylinders near flames or other ignition source.
- Acetylene cylinders will not be stored on their side.
- Copper piping will never be used for acetylene.
- Argon has a freezing point of -308.9 °F and a boiling point of -302.6 °F
- Freon (134A) has a boiling point of -15.7 °F.

Transportation of Cylinders

- End steel cap **must** be installed.
- Cylinders should never be rolled or dragged.
- Strap to a properly designed wheeled cart to ensure stability.
- Only one cylinder should be handled (moved) at a time.

Emergency Eyewash and Shower

📖 Refer to AFOSHSTD 91-501, Chap 19.

- Ensure water supply source is free from contamination and potable.
- Ensure temperature is in a range between 60 and 100 °F.
- Make sure unit is protected from direct sunlight and extreme cold temperatures.
- Activation of unit should be 1 second or less.
- Ensure stored fluid is protected from contaminants and extreme temperatures.
- The actuation device should be easily located and readily accessible.
- Ensure foot pedal, if used, is no higher than 6 inches above the floor.

- Ensure fixed units provide a minimum of 15 minutes of continuous waterflow.
- Ensure station is within 10 seconds and 100 feet of the hazardous substance.

Lockout and Tag Out

📖 Refer to AFOSHSTD 91-501, Chap 21.

General Requirements

Used to isolate equipment from its energy sources during routine maintenance procedures or to facilitate repair procedures.

- Notify all personnel when lockout and tag out are performed.
- Be aware of type and magnitude of energy sources that equipment utilizes (110, 220).
- If equipment is operating, shut it down. All switches, valves, or other energy controls are placed in the off or neutral position.
- Ensure all stored energy is released or contained (bleed off hydraulic pressure; springs are controlled either by safety chains or some type of restraining device).
- Place lockout and tag-out devices on energy-isolating devices; each device should have its own lock or tag.
- Each person locking or tagging out equipment should place a lock on the isolating device.
- With personnel clear of equipment, ensure all energy sources are disconnected and equipment will not operate.
- Return all switches or valves to off or neutral.
- Equipment is now successfully locked or tagged out
- Restore equipment using reverse order after repairs have been completed.

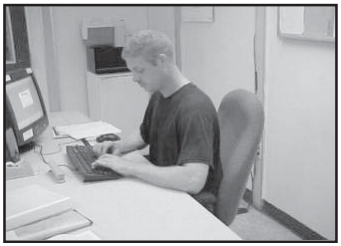
Elevated Work Areas

Vehicle Lifts

- Ensure visual, functional, and safety checks are done prior to use or according to scheduled intervals; common items to check are:
  - Fluid leaks,
  - Cracks, and
  - Function of safety supports.
- Implement lockout and tag-out procedures for all discrepancies found until items are repaired.
- When placing vehicle on lift,
  - Always use a spotter,
  - Ensure spotter stands to the side and not in front of the vehicle,
  - Make sure vehicle does not exceed maximum weight lift capacity,
  - Make sure vehicle sits squarely on lift surface, and
  - Close all doors, hood, and trunk prior to placing on lift.
- After vehicle is on lift,
  - Chock wheels and engage parking brake,
  - **Never** move the vehicle when lift is off the ground,
  - Ensure safety locks or stands are engaged after vehicle is raised to desired height, and
  - Before lowering lift, check for obstructions on all sides of lift and vehicle.
- Vehicle lifts must be kept at the lowest possible level when not in use.

Ergonomics

Carpal Tunnel



- Symptoms
  - Numbness in hands, forearms, or wrists
  - Tingling or pain in hands
  - Wrist or forearms wrinkling while typing or wrenching
- Causes
  - Improper hand and wrist positions
  - Keyboard too high, low, or far away
  - Using improper tool for the job
  - Maintaining wrist in stressful positions for an extended period of time
  - Maintaining static posture
  - Moving heavy objects at arm's length
- Preventions
  - Maintain forearms, hands, and wrists in a neutral position.
  - Use proper tool designed for the job.
  - Use wrist supports.
  - Place keyboard so upper arms stay at side of the body.
  - For jobs taking an extensive amount of time (for example, ratcheting), take short breaks to avoid putting strain on wrist.

Carpal tunnel syndrome or repetitive stress disorder can be caused by repeated and long-term use of vibrating pneumatic tools. For more information see [Online] Available: http://www.osha.gov/SLTC/ergonomics/index.html

Back, Neck, and Shoulder Strain

- Symptoms
  - Stiff neck
  - Lower and upper back pain
  - Knots between the shoulder blades
  - Numbness or tingling in shoulders, arms, or hands
  - Pain in neck or shoulder area

- Causes
  - Improper sitting position at a desk
  - Lying on concrete floor while under a vehicle
  - Prolonged forward head position
  - Sitting or laying in a twisted body position
  - Holding static posture for a prolonged period of time
  - Overreaching for items
- Preventions

DO NOT sit for prolonged periods; get up and move around.

DO NOT overreach.

  - Use a chair that conforms to the back.
  - Sit back in the chair.
  - Adjust seat to a proper height and sitting position.
  - Use creepers when working under a vehicle and use the headrest.

DO stretches to keep neck, back, and shoulders from getting stiff.

Eye Strain

- Symptoms
  - Headaches
  - Eye fatigue
  - Blurred vision
  - Dry or itchy eyes
- Causes
  - Improper lighting
  - Window light glare
  - Monitor is too close or too far away
  - Viewing the screen for long periods of time
- Prevention
  - Use droplights when working on vehicles in a hard to see area.

Have your eyes checked and a prescription check.

- When reading or working on the computer, make sure there is adequate lighting.
- If you need glasses, wear them.
- Take a break from looking at or reading computer screen.
- Use a glare screen on computer monitors.
- Clean the monitor.

Required Annual Briefings

General Requirements

- Perform all recurring or annual safety training and document Air Force Form 55.
- Brief all female workers on fetal protection program.
- Report any hazard considered to jeopardize personal safety and health to supervisors.

Fire Extinguishers (AFOSHSTD 91-501, Chap 6)

- Ensure you know the location, proper use of, and correct fire extinguisher for class of fire and hazard involved.
- Ensure they are not obstructed, obscured from view, tampered with, or activated.

Shop Evacuation

- Know proper evacuation procedures and assembly area upon exit of building.
- Know location of fire alarm boxes and protection systems within your shop.
- Evacuate facility when fire is beyond normal control and assemble at designated safety area.
- Emergency phone numbers (see inside of back cover).

Weather Hazards (AFOSHSTD 91-501, Chap 11)

- In areas where snow and ice conditions are present:

  - Keep walkways, emergency exits, and door openings free of snow and ice.
  - Walkways will be treated with appropriate nonslip material.
  - Clear snow and ice from walkways, doors, and overhangs to prevent injury.
  - When practical, allow snow or ice to melt before repairs are started.
  - When practical, snow and ice deposits from vehicles will be washed down floor drains.
  - Maintenance should be performed on nonskid surfaces (AFOSHSTD 91-20, para 1.2.7.12).
- Be aware of current weather conditions during mobile maintenance operations.
  - Cold weather—dress appropriately for period of exposure.
  - Hot weather—drink plenty of fluids and adhere to the work rest cycle if mission requirement permits.
  - Rain—have necessary wet weather protection.
- Follow local procedures when notified of adverse weather such as thunderstorms, lightning, strong winds, heavy rains, and freezing precipitation.
  - All maintenance on fuel systems or fuel servicing vehicles outside will cease (AFOSHSTD 91-20, para 9.2.7.2).

Structural Hazards

- Building inspections are usually conducted by the building custodian; however, you should be aware of the following:

  - Cracked or rusted-out support beams
  - Broken or backed-off bolts
  - Deteriorated cement blocks or concrete
  - Buckling walls
  - Structural obstacles that could cause blunt or piercing injuries
- Immediately identify, mark, and report any hazards and cordon off area if necessary.

Chapter 5
Vehicle Systems

CHAPTER CONTENTS

Varying missions at different Air Force bases may require unique vehicles to provide necessary support. Examples of these vehicles are cranes, large dozers, specialized aircraft tow vehicles, and high-reach equipment. Special care must be taken to ensure each mechanic is fully trained on the vehicle prior to performing any type of repairs.

Unique Vehicles (One of a Kind)

	Shear Points	Wrap Points	Crush Points	Pinch Points	Wire Ropes	Elevated Surfaces
A/T Forklifts	X	X	X			X
Bucket Loaders	X	X	X			X
Cranes		X	X		X	X
Crawler Tractors	X		X	X	X	X
Dump Trucks		X	X			X
Forklifts	X					X
K-loaders		X	X			X
Snow Blowers		X		X		X
Snow Broom		X		X		
Snow Plows	X	X			X	X
Tow Tractors		X	X			X
Wreckers		X	X		X	

Matrix of Vehicle Hazards
(Not an all-inclusive list of vehicles and their hazards)

PPE: Use PPE as required by manufacturer's technical orders, operating instructions, and policies.

Hazards

- Possibility of limited experience on unique vehicles.
- Unique vehicles usually have a high priority since a backup vehicle is not always available to perform their mission; mechanics may feel rushed.

DO

- Perform a vehicle safety analysis prior to starting any job.
- Observe warning and caution labels on the vehicle and in technical orders.
- Ensure you have accurate technical data prior to tackling the job.
- Read and completely understand the entire repair process prior to starting the job.

DO NOT start any job if any portion of the repair procedure does not make total sense to you (including the process listed in the manual).

DO NOT assume you know a repair procedure; use the manual that was designed for the vehicle you are attempting to repair.

DO NOT ever sacrifice safety while trying to get the vehicle back in service.

The following example, Vehicle Safety Analysis, is a great tool to summarize the uniqueness of the one-of- kind-vehicles you may have assigned. It identifies:

- Potential hazards
- Warning and cautions labels
- Required PPE
- Applicable technical orders, operating instructions, manuals, and policies

NOT A REPLACEMENT FOR TECHICAL ORDERS OR OPERATIONS GUIDES

VEHICLE SAFETY ANALYSIS #1

Vehicle Type: All-Terrain Loader

Manufacture: John Deere / Case

Analysis By: TSgt Winfield

Approved By: CMSgt Ferris

Next Review Date: June 20, 2003

Potential Hazards	Recommended Prevention Procedures
1. Steering Pinch Point	Use maintenance safety bar to prevent un-commanded steering actuation. Safety bar is located on left side.
2. Hydraulic Pressure	Pressure during operation can range to 3000 psi
3. Split Rims/Oversized tires	Refer to T.O. 36-1-191 for tire/rim procedures
4. Vehicle Height	Watch for slipping/proper hand holds

Decalcomania of Hazards

Caution Label are attached on left front drivers seat for noise "Hearing Protection Required"

Danger Label located at both sides of articulation points "Use MXS Bars"

Warning Label located above all 4 tires "Oversized Tires"

Warning Label for high pressure located near hydraulic pump "High Hydraulic Pressure"

Caution Label located on vehicle attachments "Beware Moving Parts"

Personal Protective Requirements: Steel Toe Boots, Coveralls, Gloves, Hard Hat, and Safety Glasses

NOTE: Additional hazards and specific guidance are located in T.O. 3 6M-1-123, Special Purpose SFHOJT Guide located in supervisors office, binder "C" and JSA Number 12, also in Binder "C".

NOT A REPLACEMENT FOR TECHICAL ORDERS OR OPERATIONS GUIDES

Shear Points

Shear points are created when edges of two objects move toward or next to each other closely enough to cut relatively soft material.

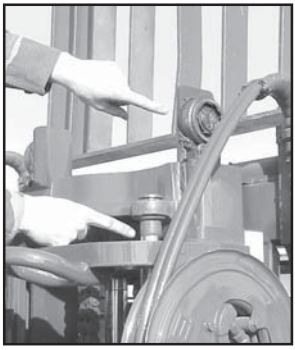
Examples of Vehicles with These Hazards

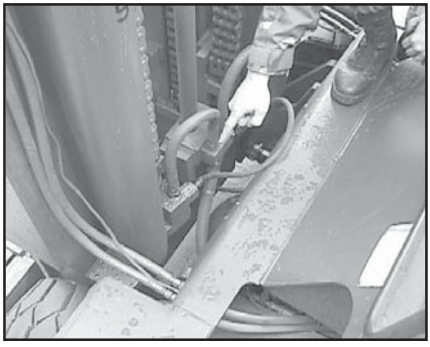
- Clam shell buckets on scoop loaders
- Forklift carriage assemblies
- Crawler tractors

Preventive Procedures

- Stay clear of shear points when equipment is in operation and shut down all power when repairing or adjusting equipment.

- Install safety bars or appropriate support device to prevent noncommanded movement.
- Lock out and tag out control levers to prevent accidental actuation.

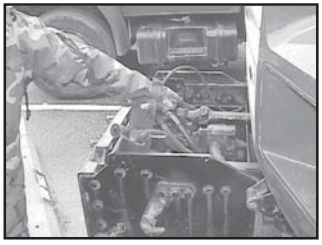




Wrap Points

Any exposed, rotating machine component is a potential wrap point.

- Injuries usually occur when loose clothing or long hair catch on and wrap around rotating shafts.
- Protruding shaft ends can also become wrap points.
- Almost impossible to escape once wrapping of clothing begins because of the power involved.
- Examples of vehicles with wrap hazard.
  - Rotary snow blowers
  - Power dividers on fire trucks
  - Drive shaft on most vehicles
  - Farm tractors
  - Dump trucks
- Preventive procedures.
  - Install safety guards and shields prior to engaging the device.
  - Check area for rags or debris prior to engaging and operating the device.



Crush Points

When a part of your body is **crushed** between two pieces of moving equipment

- Can also occur when only one piece of equipment is moving and the other is still (example: hitching a trailer to a tow vehicle or caught between a loading dock and a vehicle backing up to the dock).
- Another crush point could be between a solid object (ground, vehicle frame, and so forth) and a piece of hydraulically controlled equipment that suddenly loses pressure.
- Examples of vehicles and their crush points.
  - Flight-line tow vehicles and aerospace ground equipment
  - Dump-truck beds
  - K-loader upper decks and frame
  - Loaders and buckets
  - Loader buckets and the ground
  - Deicer or crane booms and vehicle frame
  - Any vehicle and loading dock or wall
  - MB-2 (aircraft tow tractor) tires and wheel well
- Preventive procedures.
  - Do install the maintenance stand or appropriate supporting device when working under raised platforms or equipment.

DO NOT place your body between the vehicle and other objects when spotting.

Pinch Points

Where two pieces of equipment move together and at least one of them moves in a circle.

- Can also occur where one piece of equipment is moving close to another piece that is not moving.
- Examples of pinch points: chain, belt, or gear drives.
  - Runway snow brooms
  - Where a drive belt and pulley meet
  - Point where any pair of pliers rotates
  - Moving a 55-gallon drum up close to another one—pinch points are created
  - Where heavy crates, boxes, or other objects are stacked close to each other
- Preventive actions.
  - Install pulley and gear cover before operating equipment.

DO NOT reach over moving objects.

DO NOT attempt to perform adjustments with equipment running.

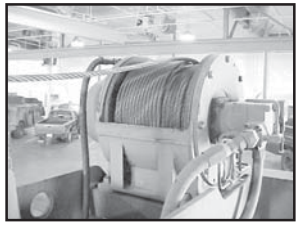
Handling Wire Rope (Cable)

- Mishandling wire rope has the potential to kill or cripple you.
- Cables under tension are the greatest danger.
  - If the cable breaks, it creates a bullwhip effect and can easily slice through a human body.
  - Always stay outside the danger zone.
- Wire ropes have the potential for producing piercing points along the length.
- Never allow cable to run through your hands.
  - Wires break and stick out of the cable.

Danger zone is the distance equal to one and one-half times the length of the cable under tension and in or on the plane of cable direction.

Always wear leather gloves to provide protection from these wires.

- Examples of vehicles with this type of hazard.
  - Cranes
  - Wreckers
  - Rollover snow plows
  - Any vehicle with a winch
- Preventive procedures.
  - Stay outside danger zone.
  - Wear leather gloves when working with cable.



Elevated Vehicle Surfaces

- **DO**
  - Keep walk areas free of oil and grease.
  - Use the appropriate fall restraint system when working in elevated baskets and platforms.
  - Ensure ladder rungs and stairs have nonslip surfaces.
  - Face the ladder when climbing up or down.
  - Assess work area for electrical lines before extending booms or platforms.

DO NOT place tools and parts in a way that could cause them to fall from the elevated surface.

DO NOT straddle the ladder and equipment on which you are working.

DO NOT carry heavy loads or many objects up or down the ladder or portable stairs.

DO NOT jump from high-elevated surfaces to the floor; use the ladder.

- Some examples of vehicles with this hazard
  - K-loaders
  - Deicers
  - Cranes
  - Excavators
  - Backhoes
  - Ladder trucks (fire rescue)
  - Basket trucks (high-reach)

Hydraulics

PPE: eye protection, protective gloves, skin protection, steel-toe boots with oil resistant soles

Hazards

- High-pressure fluids
- Skin abrasions
- Lifting
- Slipping
- High temperatures
- Infection from oil penetration

DO

- Review technical data on the system you are about to work on; ask questions about anything you do not understand.
- Maintain a clean work area, free of slipping hazards and debris.
- Block, secure, or lower to the ground all components that may move, rotate, or fall.
- Relieve system pressures; be careful of systems that use accumulators to store pressure.
- Be cautious of hot hydraulic fluid.
- Use proper test equipment that exceeds the rated pressure of the system; a good rule of thumb is to use gauges rated at twice the pressure that is expected.
- Clean up spills immediately.

DO NOT use hands or fingers to locate leaks; fluid under high pressure can be injected into the skin.

DO NOT allow hydraulic fluid to remain in contact with your skin; review applicable MSDS.

DO NOT mix different types of hydraulic fluid; follow manufacturer's specifications.

DO NOT work under equipment that is being supported by hydraulics; use a stop, safety pin, jack stand, and so forth.

DO NOT place any portion of your body in a pinch point; hydraulics can fail or activate at any time

Electrical Systems

PPE: insulated gloves and eye protection as required

Hazards

- Electrical shock
- Inadvertent actuation of mechanisms
- Electrical burns
- Fire

DO

- Follow manufacturer's procedures for troubleshooting and repairs.
- Use proper tools and equipment as specified by the manufacturer.
- Use electrical breakout equipment or test connectors as required by the manufacturer.
- Be aware of the voltage of the system you are repairing (many secondary electrical systems can exceed 50,000 volts).
- Disconnect the battery ground first and reconnect it last when disconnecting or reconnecting the battery.

Verify which type of system is in the vehicle you are repairing. Although most manufacturers use the negative from the battery for the electrical system ground, some manufacturers use a positive ground.

DO NOT replace a fuse with anything other than a fuse of the specified amperage rating.

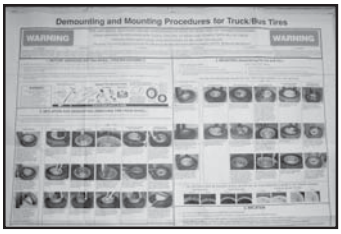
DO NOT pierce electrical insulation unless directly specified by the manufacturer. Many systems are computer-controlled, and intrusion through wiring insulation may result in false signals perceived by the computer.

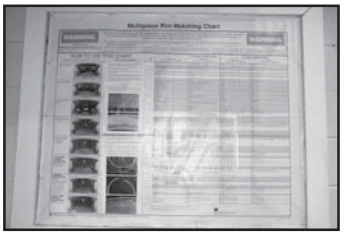
DO NOT work on electrical systems under wet conditions.

Rims and Tires

Because of the high pressures involved with pneumatic tires, special precautions are required while performing necessary maintenance. To ensure safety of equipment and personnel, everyone involved in wheel breakdown or buildup must be knowledgeable of applicable:

- Technical orders
- Rim manuals
- OSHA charts
  - Demounting and mounting procedures for truck and bus tires
  - Multipiece rim matching chart
- AFOSHSTD 91-20, Chap 8 and attachments 3, 4, 5, and 6





PPE: safety goggles and glasses or face shields, hearing protection, safety-toe shoes, and leather gloves

Supervisor Is Responsible

- For establishing program to train workers on proper techniques of servicing single piece and multipiece wheels
- For Ensuring the worker is able to demonstrate proficiency in performing the following tasks:
  - Inspection of rim components
  - Mounting of tires
  - Use of restraining devices, barriers and other equipment
  - Handling of rim wheels
  - Inflation of tire when mounted on vehicle
  - An understanding of the necessity of standing outside the trajectory both during the inflation and inspection of the tire after inflation
  - Installation and removal of rim wheels

Tire Repair

- **DO**
  - Assess the situation thoroughly prior to starting the job.
  - Ensure you wear all proper PPE.

- Remove valve cores and exhaust all air from the tire (or tires, in the case of a dual assembly) before separating the tire from the rim.
  - Probe the valve stem with a wire as a final check to ensure valve is not plugged.

DO NOT STAND in front of the valve opening, as dirt particles may be blown into your eyes.

- **DO**
  - Before a wheel assembly is removed from the axle, deflate the tire by removing the valve core in either of the following situations.
    - When tire has been driven underinflated at 80 percent or less of its recommended pressure
    - When there is obvious or suspected damage to the tire or wheel components
  - Chock the vehicle in a positive manner so it can't roll after it is jacked up.
  - Place hardwood blocks under the jack when not working on a paved (concrete or asphalt) surface.
  - Place jack stands under the vehicle, in case the jack fails.
  - Check rim diameter to ensure it matches the bead diameter molded into the tire.
  - Clean and inspect rim parts thoroughly.
  - Use new tubes and flaps in new tires.
  - Ensure tires are of an equal or greater ply rating and load range than recommended by the manufacturer.
  - Inspect inside of tires for loose cords, cuts, penetrating objects, or other carcass damage.
    - Scrap tires that are beyond simple repair.
    - Remove all dirt, debris, and liquids from the inside of the tire before a tube is installed.

- Lubricate the tire with an approved lubricant.
- Use a clip-on chuck and extension hose with remote control valve and pressure gauge, long enough to allow you to stand to one side during inflation.
- Center tire on rim before inflating.
- Lock wheel down or place assembly in a tire cage or portable safety device before attempting to inflate the tire to seat the beads.
- Use chains or forklift tines (forks) over center of the rim before inflating tires in field conditions when a tire cage is unavailable.
- Check for proper flange and lock ring seating.
- Adjust air pressure to manufacturer's recommended cold operating pressure, after beads have been seated.
- Inspect valve cores for proper air retention.
- Torque lug nuts to manufacturer's specifications when reinstalling wheels.

Never exceed manufacturer's maximum air pressure for the tire or rim.

Approved Tire Cage

Caused by Low Air Pressure

DO NOT work on tire or rim assemblies unless you have reviewed safety practices and procedures.

DO NOT loosen lug nuts on duals until all air is exhausted from both tires. A broken or cracked rim part under pressure could blow apart and seriously injure or kill if lugs are removed before air is exhausted.

DO NOT apply heat or do repair work by using heat on an inflated tire rim and wheel assembly. Heat can increase air pressure to a level sufficient to burst the tire or rim.

DO NOT reinflate a tire that has been run flat or seriously underinflated without demounting that tire and checking the tire and tube for damage.

DO NOT mix rim parts of different manufacturers unless such use is approved by those manufacturers.

DO NOT attempt to rework, weld, heat, or braze rim parts.

DO NOT reuse tubes or flaps that have buckled or creased.

DO NOT use a tube in a tire larger or smaller than that for which the tube was designed.

DO NOT inflate beyond recommended bead seating pressure.

DO NOT stand over the tire while inflating.

Air Systems

PPE: safety goggles, glasses, or face shields, hearing protection, and leather gloves

Hazards

- High-pressure, compressed air systems
- Radiator shutter systems
- Pinch points around actuating systems

DO

- Wear appropriate PPE while working on air systems.

DO NOT open any compressed air storage tank without notifying other personnel in the area of high-pitched escaping air.

DO NOT place fingers or hands near air brake actuators or slack adjusters during brake system testing or operation—possible pinch points.

DO NOT loosen air lines or fittings until all air pressure is bled off using installed air tank drain petcocks.

DO NOT place fingers between air-operated radiator shutters at the front of the vehicle. Shutters can close even when the engine is not running and can cause severe injury to fingers.

All personnel should don hearing protection.

Most heavy-duty vehicle air systems operate at 120 psi, uncontrolled release of high air pressure can cause severe injury to eyes and ears. Wear appropriate PPE.

Cooling Systems

PPE: face shields, apron, and leather gloves

Hazards

- High-pressure, hot coolant spray from radiator cap being removed or leaks on hot or overheating engine
- Skin burns from hot coolant or cooling system parts
- Severe injuries from catching hands, fingers, or clothing in rotating fan blades and automatic fan assemblies
- Cuts from sharp cooling fins and edges

DO

- Wear appropriate **PPE** while working on automotive cooling systems.

DO NOT remove the radiator cap on a hot or overheating engine (AFOSHTED 91-20, PARA 1.1.67).

Serious injury to yourself or others could result if you attempt to open a hot or overheating cooling system. Internal pressure could cause hot coolant to spray out and cause severe burns to your face and skin. You should allow the engine to cool off before opening up or working on any cooling system.

DO NOT touch hot cooling-system parts such as radiator, hoses, or thermostat housing.

DO NOT place any part of your body or clothing near engine fan assemblies.

Electric fans can turn on at any time even if the engine is not running and the ignition is turned off.

DO NOT run engines if the fan shroud assembly has been removed unless required to perform troubleshooting procedures.

DO NOT run engines if the fan assembly has cracks or possible separation as pieces of the fan blades could break off and become dangerous projectiles.

Fuel Systems

PPE: safety goggles, glasses, or face shields and leather gloves

Hazards (AFOSHSTD 91-20, para 1.1.4)

- High-pressure fuel (typically 45-100 psi for gasoline; 1,500- 3,000 for diesel)
- Fire or explosion hazard due to vapors in the air
- Asphyxiation from breathing fuel vapors
- Skin absorption or irritation
- Eye damage from direct contact of fuel or vapor irritation
- Explosion caused by static electricity or electrical sparks igniting fuel vapors
- Fuel spills and contamination of water drainage systems (AFOSH STD 91-20, para 1.2.8.1)
- Fuel contaminated clothing (AFSOHSTD 91-20, para 1.2.14)

DO

- Wear appropriate **PPE** when inspecting or servicing fuel systems.
- Remove fuel-contaminated clothing immediately to avoid skin irritation (AFOSHSTD 91-20, para 1.2.14.1).

- Flush eyes with water immediately if fuel is splashed in them (AFOSHSTD 91-20, para 1.2.14.2).

DO NOT hang fuel-contaminated clothing in closed lockers or confined spaces—need to be ventilated (AFOSHSTD 91-20, para 1.2.14.1).

DO NOT use fuel to clean floors, clothing, hands, or parts (AFOSHSTD 91-20, para 1.2.9.4).

DO NOT open any fuel system until the system pressure has been bled.

Automotive fuel systems can operate at pressures exceeding 50 psi. Follow manufacturer's procedures to bleed pressure prior to opening any fuel system.

Diesel fuel systems can operate at pressures exceeding 1,500 psi. Don't crack high-pressure fuel lines during engine operation without wearing proper PPE and consulting manufacturers' procedures.

DO NOT attempt to siphon any fuel system unless proper equipment, such as fuel bowsers, are available.

DO NOT allow any spark-producing objects (lighters, matches, and so forth) near any fuel system.

DO NOT smoke within 50 feet of any open fuel system or system maintenance.

DO NOT turn ignition on or operate fuel pump with the system open unless directed to do so by the manufacturer's troubleshooting guidance.

DO NOT attempt any welding, cutting, or soldering to any fuel tank until you consult AFOSH STD 91-20, para 9.2.6 and TO 34W4-1-5, *Operator MNL—Welding Theory and Application.*

Compressed Natural Gas (CNG) and Liquefied Natural Gas (LNG)—Alternative Fuels

PPE: gloves, antistatic clothing, eye protection

Hazards

- CNG and LNG are both highly explosive.
  - Static electricity could cause an explosion.
  - Electrical sparks could cause an explosion.
- CNG is stored under high pressure (3,000-3,600 psi).
- LNG is stored at pressures up to 150 psi.
- Asphyxiation.
- Frostbite during high-pressure gas release.

DO

- Wear appropriate PPE whenever servicing CNG or LNG systems.
- Know how to manually shut off the system if an emergency should arise.
- Ensure fittings are not under pressure prior to disconnecting. Double check to ensure valves are closed prior to removing fittings; **do no**t rely only on gauges.

- Check fittings and joints with a soapy solution to locate possible leaks after repairs are made to the system.
- Work on the systems in a well-ventilated area.
  - LNG is heavier than air and will collect in low areas.
  - CNG is lighter than air and will collect in areas that are not top-ventilated (vehicle cabs, buildings, and so forth).

DO NOT work on CNG or LNG systems unless you are fully trained on that particular system.

DO NOT wear clothing that could cause sparks or static electricity (that is, Gore-Tex Gear).

DO NOT operate electric motors or other equipment that could cause sparks in any area where CNG or LNG is present.

DO NOT smoke within 50 feet of any open fuel system or system maintenance.

Airbags

DO

- Follow **cautions** and **warnings** established in service manuals.
- Wear safety glasses when working near or handling an airbag.

- Face trim cover away from you when handling an undeployed airbag.
- Disarm airbag system when performing repairs to components or related systems.

DO NOT probe component electrical connectors with a screwdriver or other metal tools.

DO NOT try to repair airbag components unless authorized by service manual.

DO NOT probe airbag system, electrical wiring, or connectors with a test light or multimeter unless instructed by service manual.

Chapter 6
Tools and Equipment

CHAPTER CONTENTS

Technicians who use hand and power tools are exposed to hazards of falling, flying, abrasive, and splashing objects or to harmful dusts, fumes, mists, vapors, or gases and must be provided with appropriate PPE.

General Hand and Power Tool Safety

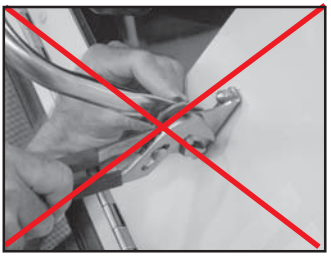
📖 Refer to OSHA 3080 and AFOSHSTD 91-20.

All technicians will be trained and certified to operate all equipment and tools including hydraulic jacks, lifts, hoists, overhead hoists, cranes, and so forth. Supervisors must document all training in the individual's training record.

Basic safety rules

- Keep all tools in good condition with regular maintenance.
- Use the correct tool for the job.

Right



Wrong

- Examine each tool before use and **do not** use damaged tools.
- Operate tools according to manufacturer's instructions.
- Provide and properly use appropriate PPE.

Broken Wrench

Hand and Tool Safety

📖 Refer to OSHA 3080, AFOSHSTD 91-20, para 1.2.6, TO 32-1-101.

*Handtools include anything operated manually, from axes to wrenches. The greatest hazards posed by hand tools result from **misuse** and **improper maintenance**.*

PPE: safety goggles or glasses and leather gloves

Be cautious when using iron or steel tools in flammable environments. Striking or dropping these objects can cause sparks and ignite the vapors of flammable gases, highly volatile liquids, or other explosive substances.

General Safety

DO NOT perform makeshift repairs to tools.

DO NOT carry tools in your hand when you climb; carry tools in tool belts or hoist tools to the work area using a hand line.

DO NOT throw tools from one location to another, one employee to another, scaffolds, or other elevated platforms.

Chisels, Wedges, Brass Drifts (and Other Similar Tools)

DO NOT use chisels, wedges, brass drifts, and so forth if head is mushroomed—the heads could shatter on impact causing sharp fragments to fly.

DO NOT use a chisel as a screwdriver; tip of the chisel may break off and become a projectile.

DO NOT cut toward yourself with a chisel.

Right

Wrong

DO

- Clamp small work pieces in the vise and chip toward the stationary jaw when you work with a chisel.

Saw Blades and Sharp Knives (and Other Similar Tools)

DO NOT use cracked saw blades.

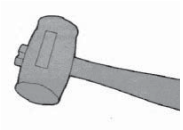
DO NOT direct sharp knives, blades, or other pointed objects toward yourself or other workers or walkways in close proximity.

Hammers

- **DO**
  - Inspect any tool with a wooden handle for looseness, splinters, or cracks (hammer, axe, and so forth). If damaged or loose, the head of the tool could fly off and strike someone.
  - Use a claw hammer for pulling nails.

Never use an unsafe hammer. Before using, check for a loose head or a cracked handle. Do not use handle as a pry bar or to knock sharp edges together.

This hammer should be replaced; the head is loose on the shaft.



DO NOT strike nails or other objects with the cheek (side) of the hammer.

DO NOT strike a hardened steel surface, such as a cold chisel, with a claw hammer.

DO NOT strike one hammer against another hammer.

DO NOT use a hammer if your hands are oily, greasy, or wet.

DO NOT use a hammer as a wedge, a pry bar, or to pull large spikes.

Files and Rasps

- **DO** grasp the handle in one hand and toe of the file in the other when using a file or rasp.

DO NOT use a file as a pry bar, hammer, screwdriver, or chisel.

DO NOT hammer on a file.

Wrenches

- **DO**
  - Inspect wrenches for out-of-round or damaged jaws; if damaged, wrench could slip allowing hands, fingers, wrists, or arms to jam into or slam against a solid or sharp object causing severe injury.
  - Ensure the wrench fits the nut or bolt you are turning.
  - Apply penetrating oil to rusted nuts and bolts that resist turning and allow time for oil to penetrate before turning.
  - Keep wrench clean and free from oil or grease.
  - Pull on the wrench instead of pushing. This practice will protect your knuckles in case wrench slips.
  - Turn adjustable wrenches so that the pulling force applies to the nonadjustable jaw.

DO NOT use a shim to make a wrench fit.

DO NOT slip a pipe over a single-head wrench handle for increased leverage.

DO NOT attempt to extend the handle in any way to increase leverage on the wrench.

DO NOT strike wrenches with hammers to tighten or loosen nuts and bolts.

DO NOT exert a hard pull on a pipe wrench until it grips the work firmly.

Screwdrivers

DO NOT carry a screwdriver in your pocket unless it is a small, pocket-sized screwdriver designed for that purpose.

Right

Wrong

DO NOT use a screwdriver if the handle is greasy or slippery in any way.

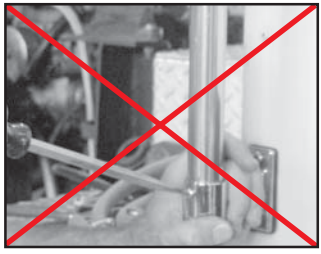
DO NOT use a screwdriver for prying, punching, chiseling, scoring, or scraping.

Wrong

DO NOT use a screwdriver near a live wire, to test the charge of a battery, or to determine if an electrical circuit is live.

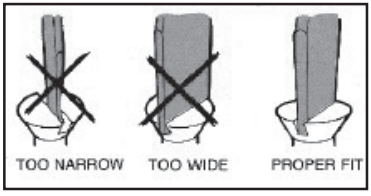
DO NOT hold the work piece against your body while using a screwdriver.

DO NOT hold the work in one hand while using screwdriver with the other.



Fingers Stabbed

- **DO** select the proper size screwdriver to match the job.



Always match the size of the screwdriver to the job; also match the type of screwdriver to the head of the screw.

Pliers

- **DO,** when performing electrical work, use pliers that have insulating rubber sleeves covering the handle.
- **DO**, when using diagonal cutting pliers, shield loose pieces of cut material from flying into the air by using a cloth or your gloved hand.

DO NOT use pliers as a wrench or a hammer.
DO NOT use pliers that are cracked, broken, or sprung.

Clamps

DO NOT use the C-clamp for hoisting materials.

DO NOT use the C-clamp as a permanent fastening device.

Bench Vises

- **DO**
  - Support the far end of the work piece by using an adjustable pipe stand, sawhorse, or box when clamping a long work piece in a vise.
  - Position the work piece in the vise so the entire face of the jaw supports the work piece.

DO NOT use a vise that has worn or broken jaw inserts or has cracks or fractures in the body of the vise.

DO NOT slip a pipe over the handle of a vise to gain extra leverage.

Shears, Snips (Tin Snips), Bolt Cutters

- **DO**
  - Wear your safety glasses or safety goggles when using snips to cut materials.
  - Wear your work gloves when cutting materials with snips.
  - Use the locking clip on the snips after you finish using them.
  - Keep the blade aligned by tightening the nut and bolt on the snips.

DO NOT use snips as a hammer, screwdriver, or a pry bar.

DO NOT use straight-cut snips to cut curves.

Power Tool Safety

📖 Refer to OSHA 3080, AFOSHSTD 91-501, Chap 18 and 91-20.

- Power tools must be fitted with **guards** and **safety switches.**
- As fatigue increases or attention decreases, mishaps are more likely to occur.
- Common hazards involved with power tools include excessive noise levels, exposed gears, belt drives, and clutch mechanisms

These tools can also be equipped with lock-on control if it allows the worker to also shut off the control in a single motion using the same finger or fingers.

PPE: safety goggles, glasses, or face shields; hearing protection, safety-toed shoes; and leather gloves

Operating Controls and Safety Switches (OSHA 3080)

- The following handheld power tools must be equipped with a constant-pressure switch or control (switch must be held in or on for tool to function; when released, tool stops working):
  - Drills
  - Fastener drivers
  - Horizontal, vertical, and angle grinders with wheels more than 2-inch diameter
  - Disc sanders with discs greater than 2-inch diameter
  - Belt sanders
  - Reciprocating, saber, and scroll saws
  - Jigsaws with blade shanks greater than 1/4-inch wide

DO NOT change or add any authorized type of switch or control to power tools unless recommended by the manufacturer.

Guards (OSHA 3080; AFOSHSTD 91-501, Chap 18 and 91-20).

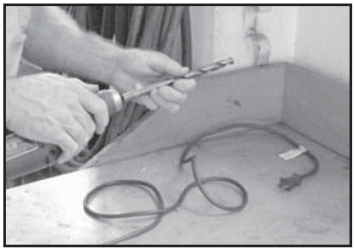
- Power tools must be fitted with guards to protect operator and others from the following:
  - In-running nip points
  - Flying chips and sparks
  - Rotating parts

Right
Guard is down

Wrong
Guard is up

- General Safety
  - **ONLY** use machines and power tools for jobs for which they were designed.
  - **NEVER** leave machines or power tools **unattended** with switch in the **on** position.
  - **ALL personnel** (operator, helper, or observer) will comply with PPE requirements for all machines or power tools.
  - **DO**
    - Keep cords and hoses away from heat, oil, and sharp edges.

- Keep tools properly lubricated; follow instructions in user's manual.
- Keep good footing and balance when operating power tools.
- Disconnect tools when not in use.
- Secure work with clamps or vise; keep hands free to control and operate tool.
- Maintain tools with care; keep them in proper working order.
- Remove all damaged power tools from service and tag them DO NOT USE.



Right

Cord is unplugged while changing attachments.

DO NOT carry a power tool by the cord; carry it by the handle or grip.

DO NOT yank the cord or hose to disconnect it from the receptacle.

DO NOT wear loose clothing, neckties, or jewelry when operating power tools.

DO NOT leave hoses or cords stretched across floor, creating a tripping hazard.

DO NOT clean or service tools or change accessories until all power is disconnected or shut off.

DO NOT hold fingers on or near switch when carrying a plugged-in tool.

Right
Work is secured in vice.

Wrong
You need both hands to control power tool.

Abrasive Wheel Tools (OSHA 3080 and AFOSHSTD 91-501 para 18.6)

The most common injuries caused by abrasive wheel tools are **lacerations** to fingers from getting caught in rotating wheels, **eye injuries** from flying fragments, and **burns** from hot sparks. Factors that cause injuries usually include fatigue, distractions, inadequate training, and disregard to safety precautions.

Abrasive grinding, cutting, polishing, and wire buffing wheels create special safety problems because they may throw off flying fragments or sparks. Wear appropriate PPE.

PPE: face shield and eye protection, hearing protection, and leather gloves

DO NOT grind soft metals such as aluminum or brass. These metals can create heavy buildup on the surface and cause the wheel to disintegrate.

- Abrasive wheel tools (bench or die grinder) **must** be equipped with guards that:

  - Cover spindle end, nut, and flange projections,
  - Maintain proper alignment with the wheel, and
  - **Do not** exceed strength of the fastenings.
- Prior to **using** any abrasive wheel tool:
  - **Inspect** the wheel for cracks or damage,
  - **Inspect** the wheel for heavy buildup of metal on surface,
  - **Ensure** all guards are in place,
  - **Don** appropriate PPE, and
  - **Ensure** wheel reaches full operating speed.

Never clamp a handheld grinder in a vise.

DO NOT run wheels at higher speeds than rated for.

DO NOT operate if grinder wheels are damaged in any way.

DO NOT grind any object on the side or above center of the wheel.

DO NOT grind any object before the wheel reaches full speed.

DO NOT grind without proper guards in place.

DO NOT attempt to dress (clean) grinder wheels without proper training.

Electrical Tool Safety

📖 Refer to OSHA 3080

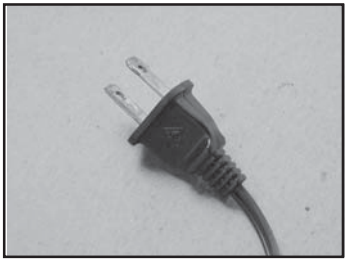
There are several dangers involved with use of electric tools. Among the **most serious** hazards are electrical burns and shocks. Shocks can lead to minor injuries or even heart failure.

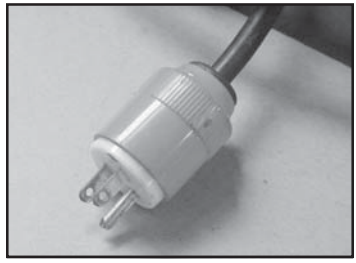
PPE: leather gloves and safety-toe boots, face, and eye protection

Before using any electrical tool, always make certain the tool is equipped with proper grounding features. Failure to have proper grounding can result in serious shock.

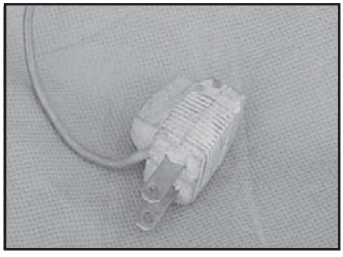
Electrical tools must:

- Have a **three-wire cord with ground prong and be plugged** into a grounded receptacle **or**
- **Be** double insulated if designed with a two-wire plug.

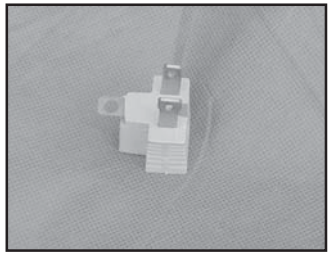




The ground prong must never be removed from a three-prong plug to accommodate a two-prong receptacle. If an adapter is used to accommodate a two-prong receptacle, the adapter wire must be attached to a known good ground.



Ground wire should be attached to approved ground.



Ground terminal should be attached to approved ground.

General Safety

- **Operate** electrical tools within their design limitations.
- **Keep** work areas well-lighted.
- **Ensure** cord outer layer is not cut or exposed in any way.
- **Ensure** cord is not a tripping hazard.
- **Store** electrical tools in a dry environment.

DO NOT use electrical tools in damp or wet locations unless approved for that purpose.

Pneumatic Tools

Pneumatic tools are powered by compressed air and include chippers, drills, hammers, sanders, and impact ratchets and guns.

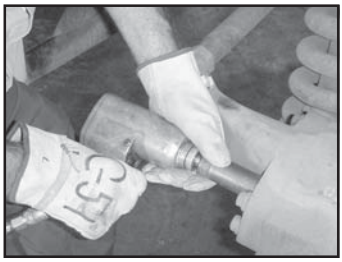
📖 Refer to OSHA 3080.

PPE: eye protection, hearing protection, safety-toed boots, and leather gloves.

When using any air tool, always follow the manufacturer's operating procedures and never exceed the manufacturer's recommended operating air pressure (typically no more than 120 psi).

Dangers associated with pneumatic tools

- Metal particles or fragments being projected by **chippers, drills, hammers or sanders;** particles include metal shavings, bolt heads, paint chips, or dust.
- Torque from impact ratchets and guns, which can jam your hands and wrists against vehicle or engine components.
- Fastener (rivet, nail, and so forth**)** not secured in tool can become a dangerous projectile.
- Pneumatic tools must be equipped with a special device to keep fasteners from being ejected until the muzzle is pressed against the work surface.

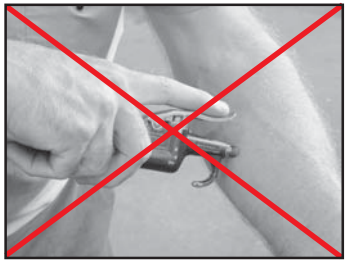


To protect your hands, always wear leather gloves when using impact tools.

- Tool attachment can become a projectile.
- A safety clip or retainer must be installed to prevent attachments from being ejected.

Compressed air guns should never be pointed toward anyone. Workers should never dead end air gun against themselves or someone else.

Screens must be set up to protect nearby workers from being struck by flying fragments from chippers, riveting guns, staplers, or air chisels and drills.



Prior to using a pneumatic tool

- Inspect the tool for serviceability according to the user's manual.
- Inspect the air hose for cuts, bulges, or bubbles.
- **Ensure** air hose is connected at both ends when air supply is on—prevents whipping of hose.

- **Ensure** air hose does not become a tripping hazard.

Fuel-Powered Tools

This hose is no good; bubble could explode.

📖 Refer to OSHA 3080—Liquid Fueled.

Fuel-powered tools (weed eaters, leaf blowers, and so forth) are usually operated by gasoline.

PPE: eye protection, hearing protection, steel-toed boots, and gloves

Dangers Associated with Fuel

- Fuel vapors can burn or explode. **No smoking** allowed while operating these tools.
- Fuel should be handled, transported, and **only** stored in approved containers.
- **Ensure** proper ABC dry chemical fire-extinguishers are available.

Fire hazard: filling gas can in pickup truck with plastic bed liner

The Safe Way to Do It

- Always place gas can on ground before refueling.
- Touch can with gas dispenser nozzle before removing can lid.
- Keep gas dispenser nozzle in contact with can inlet when filling.

DO NOT refuel without shutting down the engine and letting it cool—vapors could ignite.

DO NOT operate indoors. Fuel-powered tools can give off dangerous exhaust fumes.

Hydraulic Power Tools

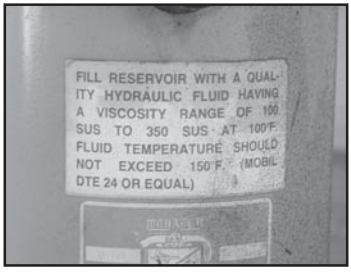
📖 Refer to OSHA 3080.

PPE: eye protection, hearing protection, steel-toe boots, and gloves

The most common hydraulic power tools used are jacks and dollies.

- Inspect hydraulic power tools and equipment prior to:
  - Each use and at least once a month (if not used on a regular basis) and
  - Performing maintenance and after maintenance is complete.
- The following **precautions** should be taken when **servicing** hydraulic power tools and **equipment:**
  - Only use the manufacturer's recommended hydraulic fluid.
  - Never exceed manufacturer's recommended safe-operating pressure for hoses, valves, pipes, and other fittings.
  - Lubricate regularly following manufacturer's recommendations.

Never use a nonapproved fluid to service or repair any hydraulic power tool. The fluid used in these hydraulic tools are of an approved fire-resistant fluid and must retain its operating characteristics in extreme temperatures to which it will be exposed.



Look for the appropriate labels on hydraulic tools.

DO NOT use a jack that leaks or has mechanical discrepancies.

DO NOT jack up a vehicle until wheels are properly chocked.

DO NOT jack up vehicle higher than required for particular maintenance task.

DO NOT exceed the stop limit.

DO NOT exceed the manufacturer's load limit. Load limit must be permanently marked in a prominent place on the tool.

DO NOT use a hydraulic jack to support a lifted load. Once the load is lifted, place jack stands (and blocks when needed) under the load to support it.

This jack is rated at 10 tons roughly capable.

Procedures for Setting Up a Jack

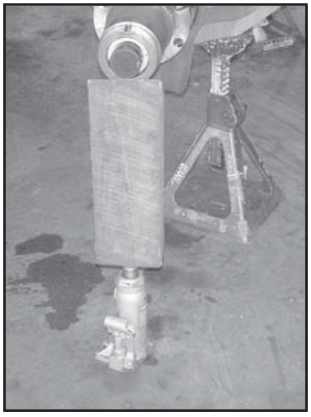
- **Ensure** the base of the jack rests on a firm surface.
- **Ensure** jack is correctly centered.
- **Ensure** jackhead bears against a level and flat surface.
- **Ensure** lift force is applied evenly.
- **DO** ensure vehicle transmissions are **securely mounted** to the transmission jacks before lowering or moving the jack.

Jack Stands

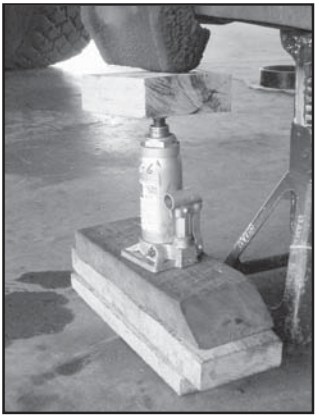
- **DO**
  - Place a flat block under the base of a jack stand if the foundation is not firm.

This will keep the jack stand from sinking into the ground.

  - Place a flat block between the jack cap (top) and the load if it looks like the jack might slip out from the load or not balance properly.



Wrong
Wood Is Not Stable



Right
Wood Is Stable—
Forced Applied Evenly

- Remove defective jack stands from service immediately and tag for the Defense Reutilization and Marketing Office (DRMO) or scrap metal.

Air Compressors

📖 Refer to AFOSHSTD 91-20, Chap 5.

- Only qualified personnel should be allowed to repair or adjust pressure-regulating equipment.
- Personnel operating air compressors should be familiar with operating instructions.

DO NOT use compressors if drive belt guards are missing.

DO NOT exceed maximum shop air line pressure when adjusting the pressure regulator.

DO NOT kink a hose to stop airflow.

DO NOT use water-hose type clamps to replace broken airhose fittings

DO

- Tag or mark installed air-pressure line outlets showing maximum working pressure.
- Check oil levels at least once a week.
- Inspect oil for evidence of moisture (oil will have a tan creamy appearance).

- Open tank drain daily to remove moisture buildup.

When used for approved cleaning, compressed air will be regulated to less than 30 psi. DO NOT use compressed air to spin dry bearings.

All safety valves should be tested at regular intervals by installation civil engineering to determine if they are in good condition.

Lifting Devices

📖 Refer to AFOSHSTD 91-20, Chap 7.

- **Inspect** and **maintain,** on a regular basis, following manufacturer's instructions.
- **Training** is crucial to **safe** operation of shoplifting devices.
  - Supervisors should use manufacturer's instructions to train on proper care and operation.
  - Testing and certification of cranes and hoists will be performed by qualified inspectors and maintenance personnel.
  - If manuals or instructions cannot be found, order via the Internet.

Engine Hoists

DO NOT place yourself between the engine hoist and vehicle while it is being moved into position.

DO NOT place your hands near cylinders or arm pivot points while operating hoist.

DO NOT place any part of your body between load (engine, transmission, and so forth) and floor while load is suspended in the air.

Tool Box Safety and Tool Accountability

📖 Refer to AFMAN 24-307; para 3.83.

Tool Box Safety

- **DO**
  - Clean all tools before returning them to the tool crib.
  - Lock wheels on large tool boxes, chests, or cabinets to prevent them from rolling.
  - Close and lock all drawers and doors before moving the tool chest to a new location.

*Each **individual** is **ultimately** responsible for tool control because the individual is the one using the tools.*

DO NOT place a tool back in the tool crib if it is broken or otherwise unserviceable.

DO NOT place broken tools back in your box; turn them into your supervisor.

DO NOT leave tools in or on vehicles you are working on. Do a complete inventory prior to releasing vehicle; this can cause foreign object damage (FOD).

FOD

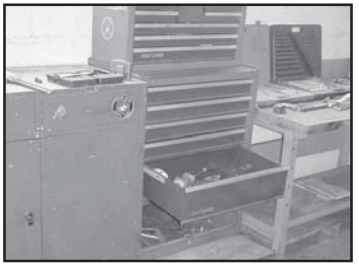
Things like tools, hats, pens, pencils, and parts that get dropped on the flight line or taxiways can be ingested by aircraft engines, causing severe damage to multimillion-dollar weapon systems.

DO NOT let tools sit on or near an engine when it is running. Tools can move due to the vibration and fall into the fan or alternator assembly and become projectiles.

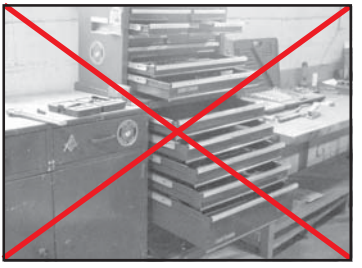
DO NOT leave toolbox drawers open.

Wrong
Open toolbox drawers can be a severe safety hazard.

DO NOT open more than one toolbox drawer at a time—can cause toolbox to tip over.



Right
Open one toolbox drawer at a time.



Wrong
Too many toolbox drawers open can box to tip.

DO NOT stand on toolboxes, chests, or cabinets to gain extra height.

DO NOT move a toolbox, chest, or cabinet if it has loose tools or parts on the top.

Equipment Inspection and Serviceability

📖 Refer to TO 34-1-3

Document all inspections and maintenance on:

- AFTO Form 244, Industrial and Support Equipment Record;
- DD Form 1574, Serviceable (yellow tag);
- DD Form 1577-2, Unserviceable (Repairable) (green tag); and
- DD Form 1577, Unserviceable (Condemned) (red tag).

Inspection and maintenance requirements for all machinery and shop equipment will be determined by appropriate technical order when available. If none available, follow TO 34-1-3 (para: 8f, pages 3-4).

Reporting Unsafe Tools and Equipment (Reference: TO 34-1-3)

- Unsafe tools
  - Turn in to your supervisor.
  - Supervisor gives it to materiel control to get a replacement.
  - For unsafe electrical tools: lock out and tag out control switch to the off position
- Unsafe equipment
  - Report it to your supervisor. Your supervisor will, in turn, annotate the AFTO Form 244.
  - Tag it with appropriate DD Form 1577 (Red), Unserviceable (Condemned), or 1577-2 (Green) Unserviceable (Reparable) tags.
  - Lock out and tag out the power supply and the control switch to off position.
  - Move it to a different location from the serviceable equipment, if possible.
  - Some minor repairs can be fixed in-house following user's manual and all safety precautions.
  - Some repairs are beyond shop capability and should be accomplished by a certified repair shop (contract).
  - If beyond repair, turn equipment in to DRMO for scrap if possible.

Chapter 7
HAZMAT

Special Interest

CHAPTER CONTENTS

Hazardous Material (HAZMAT)

General Information

- In accordance with AFI 32-7086, HAZMAT is defined as "any item or class of items referenced in Federal Standard 313D, paragraph 3.2 and all Class I and Class II Ozone Depleting Substances (ODS)."
- HAZMAT is defined by OSHA. Any item or chemical that is a health hazard or physical hazard as defined by OSHA in 29 CFR 1910.1200, which includes the following:
  - Health hazards
    - Chemicals that are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins (liver), nephrotoxins (kidney), and neurotoxins (nerves).
    - Chemical agents that act on the hematopoietic (blood) system.
    - Chemical agents that damage the lungs, skin, eyes, or mucous membranes.
    - Exposure to chemicals and dust can cause some people to develop allergic reactions, which can happen immediately or over time AFOSHSTD 48-8, 91-501, chap 14 or [Online] Available: http://www.osha.gov/SLTC/dermalexposure/index.html
  - Physical hazards
    - Chemicals that are combustible liquids, compressed gases, explosives, flammable liquids, flammable solids, organic peroxides, oxidizers, pyrophorics, unstable (reactive), or water reactive. For example, acid burns that occur from batteries are physical hazards.
    - Flammable liquid, flashpoint below 100 °F.
    - Combustible liquid, flashpoint above 100 °F and below 200 °F.

- Chemicals that, in the course of normal handling, use, or storage operations may produce or release dusts, gases, fumes, vapors, mists, or smoke that may have any of the above characteristics.

Ozone Depleting Substances

- Class I
  - By international agreement, all production of Class I ODS effectively ended on 31 December 1995.
  - Class I ODS cannot be obtained through local purchase.
  - Examples include chlorofluorocarbon (CFC R-12), halon, and trichloroethane.
- Class II
  - By international agreement, Class II ODS will be managed under incremental reduction until production has ceased by 2030.
  - This includes, but is not limited to, hydrochlorofluorocarbon (HCFC R-134a).

Storage of HAZMAT—Storage References and Basic Requirements

- Never store materials such as paper, wood, or laminates in flammable lockers to prevent fire hazards.
- Once a HAZMAT is received, it must be properly stored in the handling and storage section on MSDS.
- All HAZMAT storage must be compatible with materials contained and approved by base fire department and bioenvironmental engineering (AFOSHSTD 91-68 and 91-501, Chap 22).

- Most HAZMAT storage and handling fall under the requirements for flammable and combustible liquids in AFOSHSTD 91-501, Chap 22. Store like items together and never mix incompatible items.

VS

- Material incompatibility.
  - Certain materials will not be stored together.
  - Fire, explosion, heat, and lethal gas can produce some unfavorable effects.
  - Some examples of incompatibility are:
    - Flammables and corrosives,
    - Acids and caustics,
    - Reactives and ignitables (flammable or combustible),
- Flammables and combustibles, and
- Oxydizers and any combination.

Material Safety Data Sheet

- Each shop and work center must:
  - Maintain an MSDS for each hazardous material procured, stored, or used at the work center;
  - Ensure each manufacturer has its own MSDS; and
  - Ensure the most recent revision of a specific MSDS is available.
- MSDS can be obtained from the Hazardous Material Information Resource System [Online] Available: http://www.dlis.dla.mil/hmirs/default.asp
- Some options for organizing a MSDS file system:
  - File alphabetically by national stock number.
  - Separate tabs for each type of material.
  - Assign numbers for cross-reference to the inventory list and locker storage location.

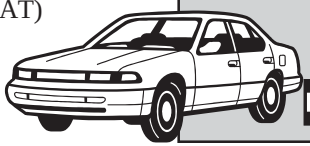
- Consult MSDS before mixing chemicals to prevent burns, gas exposure, and explosion.
- Some common HAZMAT labels are:

Hazardous Waste

General Information

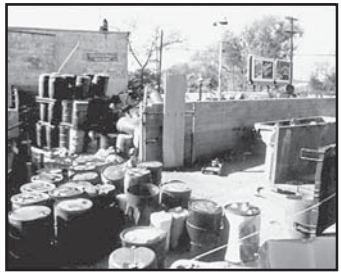
- Hazardous waste—a discarded material that may be solid, semisolid, liquid, or contained gas. The material either exhibits a hazardous waste characteristic or is determined to be a hazardous waste by Federal, state, or local policies.
- Federal law requires shops that generate hazardous waste to offer and document awareness training for all employees who work with hazardous waste (FED-STD 313, OSHA STD 29, and CFR 1910.1200).
  - Consists of instructions regarding satellite point requirements and hazardous waste information from waste profile sheets.
  - Training should not be confused with hazardous material (HAZMAT) or HAZCOM training.

Remember, you are acting on behalf of the US Government on any hazardous waste action. You must ensure you are aware of your local disposal policies. Each location, including all overseas locations, has its own unique method for classification, containment, and disposal. Your unit hazardous waste monitor can answer any specific questions regarding proper disposal procedures. Good management builds trust between the base and its surrounding population.



Maintenance Safety

- Become familiar with your internal hazardous waste disposal instructions; some general rules apply to hazardous waste no matter the location.



- Most vehicle maintenance shops only allow accumulation up to 55 gallons of hazardous waste *or* 1 quart of acutely hazardous waste.
  - Containers must remain closed at all times, except when adding or removing waste.
  - Ensure proper labels are affixed to containers; if in doubt about the chemical constituents, consult the waste profile sheets.

Hazardous Chemical Warning Label

- A label, tag, or marking must be affixed to a hazardous waste container and provides the following:
  - Appropriate hazard warnings, and hazardous waste label located in clear view.
  - Name and address of manufacturer, importer, or other responsible party.
  - Label must be properly prepared in accordance with Department of Defense 6050.5-H.
  - All hazardous waste must be accumulated in Department of Transportation-approved containers with a UN label or stamp located near or on the bottom.

Important Accumulation Point Inspection Criteria.

- At least a weekly inspection should be carried out of the accumulation point; this entails:
  - Inspecting for rusted or damaged containers,

  - Inspecting the level of each waste accumulated, and
  - Observing the general condition of the area.
- Containers should be filled to no more than 90 percent of their capacity for expansion purposes.
- Properly identify satellite accumulation point.

Most hazardous waste of different waste streams must be separated by at least 2 feet.

Material incompatibility

- Certain wastes will not be stored together.
- Fire, explosion, heat, and lethal gas can produce some unfavorable effects.
- Some examples of incompatibility are:
  - Flammables and corrosives
  - Acids and caustics
  - Reactives and ignitables (flammable or combustible)
  - Flammables and combustibles
  - Oxydizers and any combination

Hazardous Waste Handling

- Avoid potential harm to yourself, other personnel, and the environment.
- Use caution and keep all containers closed and sealed when not in use and become familiar with handling procedures.
- Use PPE as required by local operating instructions.

The fire department does not respond to all spills.

Hazardous Waste Management and Spill Plans

- Ensure you are aware of local spill plans, where they are located, and local guidance on hazardous waste site-specific management plans.
- Be sure to read and understand directives and local operating instructions.

For your use. Fill in the information below for your reference.

Fire Department or Spill Response Team _____

Security Forces _____

Ambulance _____

Bioenvironmental _____

Environmental Coordinator _____

Accumulation Point Manager _____

Hazardous Material and Hazardous Waste References

Internet Resources

- General Sources
  - Headquarters US Air Force Environmental Division (USAF/ILEV) [Online] Available: https://www.il.hq.af.mil/ile/ilev/
  - Environmental Protection Agency (EPA) [Online] Available: http://www.epa.gov
  - Air Force Center for Environmental Excellence (AFCEE) [Online] Available: http://www.afcee.brooks.af.mil/
  - Environmental Health and Safety [Online] Available: http://ehso.com
  - Pollution Prevention and Environmental Assistance [Online] Available: http://www.p2pays.org

  - Defense Environmental Information Exchange [Online] Available: http://www.denix.osd.mil/
  - PRO-ACT [Online] Available: http://www.afcee.brooks.af.mil/pro-act/pro-acthome.asp
  - Air Force Institute of Technology (AFIT) training course schedules [Online] Available: http://cess.afit.af.mil/Course_List.cfm
  - Hazardous Communication (base reference) [Online] Available: http://www.au.af.mil/42abw/42cs/maxins/48-102.pdf
- MSDS Sources
  - Vermont SIRI [Online] Available: http://hazard.com/msds/
  - MSDS Search [Online] Available: http://www.msdssearch.com/
  - ILP, Inc [Online] Available: http://www.ilpi.com/msds/
- Shelf-Life Sources
  - SLED [Online] Available: http://www.robins.af.mil/ti/tiel/sled.htm
  - QSL [Online] Available: http://www.dscr.dla.mil/environmental.htm

Policy Resources

- AFI 32-7042, *Solid and Hazardous Waste Compliance*
- AFI 32-7080, *Pollution Prevention Program*
- AFI 32-7086, *Hazardous Materials Management*
- AFMAN 23-110, Volume 7, Part 3, *USAF Supply Manual–The Air Force Shelf-Life Program*
- AFOSHSTD 91-68, *Chemical Safety*
- AFOSHSTD 91-501, *Air Force Consolidated Occupational Safety Standard*
- AFOSHSTD 161-21, *Hazard Communication*
- TO 42A2-1-4, *Storage Control of Coating Materials*
- TO 42B-1-1, *Quality Control of Fuels and Lubricants*
- TO 42C-1-12, *Quality Control of Chemicals*

Chapter 8
Mishap Reporting Procedures

Special Interest

CHAPTER CONTENTS

It is important that you know what to do when something in the work area is unsafe; when you come across an unsafe situation in the shop, think SAFE.

Reporting of Unsafe Work Center Hazards

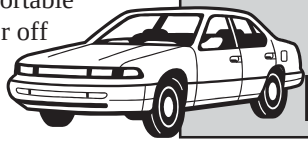
- **S**ecure the unsafe area or equipment. Mark area or equipment as unsafe, using available resources; for example, lockout, tag out, or cordons.
- **A**lert others. Ensure those in the surrounding area are aware of the hazard.
- **F**orward information:
  - Immediately inform your supervisor of the unsafe situation.
  - Be specific when reporting.
  - Include:
    - What the hazard is
    - Where it is
    - Who knows about it
    - Why it is unsafe
    - When you discovered it
- **E**liminate the hazard. Work with your supervisor to mitigate the hazard by correcting the unsafe condition.

Mishap Reporting Procedures

Accident and Mishap Reporting Procedures

- In the event of a reportable accident, either on or off duty, the following general guidelines apply.

All organizations will follow written mishap reporting procedures. Procedures must be posted on each work center's safety board and a sample form (with instructions on how to properly complete it) must be posted in an accessible location in the workplace.



- Notify:
  - Supervisor.
  - Element, flight, or squadron ground safety officer and noncommissioned officer in charge.
  - After normal duty hours, contact a 24-hour operations section within the squadron (usually designated by the squadron commander).
- Wing safety must be notified in accordance with AFI 91-202.
- Be able answer the following questions:
  - What type of accident?
  - Who or what was involved?
  - Was there any damage or injury?
  - When, where, and how?
  - Approximate time of mishap?
- All mishap sites will be preserved, whenever possible, until the mishap undergoes investigation by the safety office.

Air Force Form 457, *USAF Hazard Report and Reporting Procedures*

- Air Force Form 457 provides a system of reporting hazardous conditions and their subsequent investigation and correction (for example, live power wires exposed from removal of a piece of shop equipment).
- If the hazard is eliminated on the spot, no further action is required, unless it applies to other units or similar operations.
- Reports may be submitted anonymously.
- If a hazard presents imminent danger, the supervisor or individual must take immediate action to correct the situation and apply interim control measures.
- Safety office will:
  - Investigate alleged hazard,
  - Keep you informed of the status, and
  - Monitor hazard until it is corrected.

- If response to a hazard report is not satisfactory, you may request a reevaluation in accordance with AFOSHSTD 91-301.

USAF HAZARD REPORT	HAZARD REPORT NO. (*Assigned by Safety Office*) (Leave Blank)
I. **HAZARD** *(To be completed by individual reporting hazard.)*	
TO: CHIEF OF SAFETY *(Organization and location)* (Your Installation Safety Office)	**FROM:** *(Optional – Name, Grade and Organization)* (Originator's Information)
TYPE – MODEL, SERIAL NUMBER, A.G. E./MATERIAL/FACILITIES/PROCEDURE OR HEALTH HAZARD INVOLVED (Specific details of equipment, material, facilities, or procedures involved)	
DESCRIPTION OF HAZARD *(Date, Time, SUMMARY – Who, What, When, Where, How)* (This section is used to explain the hazard—the Who, What, When… If possible, include the number of people exposed to the hazard)	
RECOMMENDATIONS *(Originator – Not Mandatory)* (Although not mandatory, the originator should be encouraged to recommend solutions. The originator is often in the best position to understand the problem and often corrective actions.)	

DATE RECEIVED (Leave Blank)	REVIEWING PERSON *(Typed or printed name, grade, and position or title)*	SIGNATURE	DESIGNATED OPR (Leave Blank)
DATE FORWARD (Leave Blank)	(Leave Blank)		SUSPENSE DATE (Leave Blank)

AF FORM 457, 19730901 (*IMT-V1*)

Acronyms and Glossary

A

AFCEE	Air Force Center for Environmental Excellence
AFI	Air Force Instruction
AFMAN	Air Force manual
AFOSHSTD	Air Force Occupational Safety and Health Standard
AFPAM	Air Force pamphlet
AFTO	Air Force technical order

B

BE	bioenvironmental engineering

C

Cautions	Highlights an operation or maintenance procedure, practice, condition, or statement that, if not strictly observed, could result in damage and destruction of equipment or loss of mission effectiveness
CES	civil engineering squadron
CFR	Code of Federal Regulations
Carcinogens	Agents that can cause cancer. In industry, there are many potential exposures to carcinogens. Generally, workplace exposures are considered to be at higher levels than for public exposures. MSDS should always contain an indication of carcinogenic potential. The following Internet links are quite general; specific searches may be productive for specific agents (for example, trichloroethylene and asbestos).
Carpal Tunnel	Syndrome or repetitive stress disorder caused by repeated and long-term use of vibrating pneumatic tools.

D

Danger	Indicates an imminently hazardous situation, which, if not avoided, will result in death or serious injury. This is limited to the most extreme situations.
DENIX	Defense Environmental Information Exchange
Diisocyantes	A compound containing two isocyantes (a compound containing the univalent radical) group in the molecule and sometimes used in making resin and plastics
DOT	Department of Transportation
DRMO	Defense Reutilization Marketing Office
DD Form	Department of Defense Form

E

EPA	Environmental Protection Agency
Ergonomics	The applied science of equipment design, intended to maximize productivity by reducing operator fatigue and discomfort (also called biotechnology or human engineering)

F

FED-STD	Federal standard
FOD	foreign object damage

H

Hazardous Waste	A discarded material that may be solid, semisolid, liquid, or contained gas; material either exhibits a characteristic of a hazardous waste or is determined by Federal, state, or local policies

HAZCOM	Hazardous communication (program informing personnel of the hazards associated with and proper preventive measures to be taken when using or handling hazardous materials in the workplace)
HAZMAT	Hazardous material (any item or chemical which is a health hazard or physical hazard)
HCFC	hydrochlorofluorocarbon
HEPA	high-efficiency particulate air filter

J

JCALS	joint computer-aided acquisition and logistics support
JQS	Job Qualification Standard Continuation and Command

M

MSDS	material safety data sheet

N

NFPA	National Fire-Protection Association
NIOSH	National Institute for Occupational Safety and Health
Notes	Highlights essential information, conditions, or procedures

O

OI	operating instructions
OJT	on-the-job training
ORM	operational risk management
ODS	ozone depleting substances
OSHA	Occupational Safety and Health Administration

P

PEL	permissible exposure limits
PPE	personal protective equipment
psi	pounds per square inch
Pyrophorics	chemical capable of igniting spontaneously in air

Q

QSL	quality status list

R

RPM	revelations per minute

S

SIRI	Safety Information Resources, Inc
SLED	shelf-life extension data

References

Chapter 1—Operational Readiness Management

Operational Risk Management
AFPAM 90-902, *Operational Risk Management (ORM) Guidelines and Tools*

Chapter 2—Individual Responsibility (Health and Wellness)

Basic Responsibilities

AFOSHSTD 91-501, *Air Force Consolidated Occupational Safety Standard*, chapter 2

Personal Protective Equipment

AFOSHSTD 91-501, *Air Force Consolidated Occupational Safety Standard*, chapter 14

Housekeeping

AFOSHSTD 91-501, *Air Force Consolidated Occupational Safety Standard*, chapter 5

Two-Man Concept

AFI 24-302, *Vehicle Maintenance Management*, paragraph 2.14.10
AFMAN 24-307, *Procedures for Vehicle Maintenance Management*, paragraph 1.39.42.5
AFOSHSTD 91-20, *Vehicle Maintenance Shops*, paragraph 9.2.7.8

Procedures to Report TO Deficiencies

TO 00-5-1, *Air Force Technical Order System*, chapter 5

Chapter 3—Work Center Hazards

Manual Lifting

AFOSHSTD 91-20, *Vehicle Maintenance Shops*, paragraph 1.2.13
AFOSHSTD 91-501, *Air Force Consolidated Occupational Safety Standard*, chapter 4

Grinding
—Ring Test

AFOSHSTD 91-501, *Air Force Consolidated Occupational Safety Standard*, paragraph 18.6.2.5.1.3

T

TM	technical manual
TO	technical order

W

Warnings	Highlights an operation or maintenance procedure, practice, condition, or statement, which, if not strictly observed, could result in injury to or death of personnel

Cutting	
—Cutting with Machinery	AFOSHSTD 91-20, *Vehicle Maintenance Shops* AFOSHSTD 91-501, *Air Force Consolidated Occupational Safety Standard*, Chap 14 and 18
—Cutting with a Torch	AFOSHSTD 91-5, *Welding, Cutting, and Brazing* AFOSHSTD 91-20, *Vehicle Maintenance Shops* AFOSHSTD 91-25, *Confined Spaces*
General Welding Operations	AFOSHSTD 91-5, *Welding, Cutting, and Brazing*
Painting	AFOSHSTD 91-20, *Vehicle Maintenance Shops,* Chap 5
Batteries	AFOSHSTD 91-66, *General Industrial Operations*, paragraph 1.3 AFOSHSTD 91-20, *Vehicle Maintenance Shops*
Slips, Trips, and Falls	AFOSHSTD 91-501, *Air Force Consolidated Occupational Safety Standard*, Chap 7
Confined Spaces	OSHA Regulation (Standards-29 CFR) 1910.146 *Permit Required Confined Spaces* AFOSH STD 91-25, *Confined Spaces*

AFOSHSTD 48-137, *Respiratory Protection Program*

Chapter 4—Shop Awareness

Electrical Safety

AFOSHSTD 91-501, *Air Force Consolidated Occupational Safety Standard*, Chap 8

—Lighting

AFOSHSTD 91-501, *Air Force Consolidated Occupational Safety Standard*, paragraph 5.7
National Fire-Protection Association Standard 101

—Electrical

AFOSHSTD 91-501, *Air Force Consolidated Occupational Safety Standard*, paragraph 7.5.2.10

Ventilation

AFOSHSTD 48-2, *Industrial Ventilation*
AFOSHSTD 161-2, *Industrial Ventilation*—located on the following Web site: https://www.afms.mil/occ_env/lframe.htm

—Shop Ventilation

AFOSHSTD 91-20, *Vehicle Maintenance Shops*, paragraphs 1.2.12.3, 1.2.3.1.1.1, 1.2.3.1.1.2, and 1.2.3.1.1.3

—Battery Shop

AFOSHSTD 91-66, *General Industrial Operations*, paragraph 1.3

—Paint Shop

AFOSHSTD 48-2, *Industrial Ventilation*
OSHA 29 CFR 1910.107, *Spray Finishing Using Flammable and Combustible Liquids* HA 29 CFR 1910.107

—Welding Shop

AFOSHSTD 91-5, *Welding, Cutting, and Brazing*, paragraph 3.18

Compressed Gases

AFOSHSTD 91-20, *Vehicle Maintenance Shops*, Chap 6

Emergency Eye

Wash/Shower

AFOSHSTD 91-501, *Air Force Consolidated Occupational Safety Standard*, Chap 19

Lockout/Tag Out

AFOSHSTD 91-501, *Air Force Consolidated Occupational Safety Standard*, Chap 21

Required Annual Briefings

—Fire Extinguishers

AFOSHSTD 91-501, *Air Force Consolidated Occupational Safety Standard*, Chap 6

—Weather Hazards

AFOSHSTD 91-501, *Air Force Consolidated Occupational Safety Standard*, Chap 11
AFOSHSTD 91-20, *Vehicle Maintenance Shops*, paragraph 1.2.7.12 and 9.2.7.2

Chapter 5—Vehicle Systems

Nuclear Surety

TO 00-110N-16, *Equipment Authorized for Use with Nuclear Weapons*
AFI 24-302, *Vehicle Maintenance Management*, paragraph 2.13

Rims and Tires

OSHA charts:
Demounting and Mounting Procedures for Truck and Bus Tires
Multipiece Rim Matching Chart
AFOSHSTD 91-20, *Vehicle Maintenance Shops*, Chap 8 and attachments 3, 4, 5, and 6

Cooling Systems

AFOSHSTD 91-20, *Vehicle Maintenance Shops*, paragraph 1.1.6.7

Fuel Systems

AFOSHSTD 91-20, *Vehicle Maintenance Shops*, paragraph 1.1.4, 9.2.6, 1.2.9.4, 1.2.14, 1.2.14.1, and 1.2.14.2
TO 34W4-1-5, *Operator MNL – Welding Theory and Application*

Chapter 6—Tools and Equipment

General Hand and Power Tool Safety

OSHA 3080, *Hand and Power Tools*
AFOSHSTD 91-20, *Vehicle Maintenance Shops*

Hand and Tool Safety

OSHA 3080, *Hand and Power Tools*
AFOSHSTD 91-20, *Vehicle Maintenance Shops*, paragraph 1.2.6
TO 32-1-101, *Use and Care of Hand Tools and Measuring Tools*

Power Tool Safety

OSHA 3080, *Hand and Power Tools*
AFOSHSTD 91-12, *Machinery*
AFOSHSTD 91-20, *Vehicle Maintenance Shops*
AFOSHSTD 91-501, *Air Force Consolidated Occupational Safety Standard*, Chap 18

—Abrasive Wheel Tools

AFOSHSTD 91-501 *Air Force Consolidated Occupational Safety Standard*, paragraph 18.6

Electrical Tool Safety

OSHA 3080, *Hand and Power Tools*

Pneumatic Tools

OSHA 3080, *Hand and Power Tools*

Fuel-Powered Tools

OSHA 3080, *Hand and Power Tools*

Hydraulic Power Tools

OSHA 3080, *Hand and Power Tools*

Air Compressors

AFOSHSTD 91-20, *Vehicle Maintenance Shops*, Chap 5

Lifting Devices

AFOSHSTD 91-20, *Vehicle Maintenance Shops*, Chap 7

Tool Box Safety and Tool Accountability

AFMAN 24-307, *Procedures for Vehicle Maintenance Management*, paragraph 3.83

Equipment Inspection and Serviceability

TO 34-1-3, *Inspection and Maintenance—Machinery and Shop Equip*

Chapter 7—Hazardous Material and Hazardous Waste

Hazardous Material

—General Information

CFR 29, *Labor*, Section 1910.1200, *Hazard Communication*
AFI 32-7086, *Hazardous Materials Management*
AFOSHSTD 48-8, *Controlling Exposures to Hazardous Materials*
AFOSHSTD 91-501, *Air Force Consolidated Occupational Safety Standard*, Chap 14

—Storage of HAZMAT

AFOSHSTD 91-68, *Chemical Safety*
AFOSHSTD 91-501, *Air Force Consolidated Occupational Safety Standard*, Chap 22

Hazardous Waste

—General Information

CFR 29, *Labor*, Section 1910.1200, *Hazard Communication*

—Hazardous Chemical Warning Label

DoD 6050.5-H, *DoD Hazardous Chemical Warning Labeling System*

Other References

AFI 32-7042, *Solid and Hazardous Waste Compliance*
AFI 32-7080, *Pollution Prevention Program*
AFI 32-7086, *Hazardous Materials Management*
AFMAN 23-110, Volume 7, Part 3, *USAF Supply Manual – The Air Force Shelf-Life Program*
AFOSHSTD 91-68, *Chemical Safety*
AFOSHSTD 91-501, *Air Force Consolidated Occupational Safety Standard*
AFOSHSTD 161-21, *Hazard Communication*
TO 42A2-1-4, *Storage Control of Coating Materials*

TO 42B-1-1, *Quality Control of Fuels and Lubricants*
TO 42C-1-12, *Quality Control of Chemicals*

Chapter 8—Mishap Reporting Procedures

Mishap Reporting Procedures
—Accident/Mishap Reporting Procedures

AFOSHSTD 91-202, *The US Air Force Mishap Prevention Program*

—Air Force Form 457

AFOSHSTD 91-301, *Air Force Occupational and Environmental Safety, Fire Protection, and Health (AFOSH) Program*

Because AFOSHSTD 91-20 and 91-501 are the most referenced in this handbook, the chapter titles are listed for your convenience.

AFOSHSTD 91-20, *Vehicle Maintenance Shops*

Chapter 1. General
Chapter 2. Battery Maintenance
Chapter 3. Cleaning Operations
Chapter 4. Paint Shop
Chapter 5. Air Compressors
Chapter 6. Compressed Gas Cylinders
Chapter 7. Lifting Devices
Chapter 8. Tire and Wheel Maintenance
Chapter 9. Maintenance Operations
Attachment 1. Glossary of References, Abbreviations, Acronyms, and Terms
Attachment 2. Ordering Information for Occupational Safety and Health Administration (OSHA) Rim Charts
Attachment 3. Effects of Rim Design on Proper Mounting Position
Attachment 4. Using the Extension Hose to Inflate a Tire
Attachment 5. Tire Inflator Cage
Attachment 6. Trajectory
Attachment 7. Checklist—Vehicle Maintenance Shops

AFOSHSTD 91-501, *Air Force Consolidated Occupational Safety Standard*

Chapter 1. Introduction

Chapter 2. Human Factors
Chapter 3. Physical Hazards
Chapter 4. Manual Material Handling and Lifting
Chapter 5. Housekeeping
Chapter 6. Fire Protection
Chapter 7. Walking Surfaces, Guarding Floor and Wall Openings, Fixed Industrial Stairs, and Portable and Fixed Ladders
Chapter 8. Electrical Safety
Chapter 9. Jewelry
Chapter 10. Office Safety
Chapter 11. Adverse Weather
Chapter 12. Hand Tool and Portable Power Tools
Chapter 13. Fall Protection
Chapter 14. Personal Protective Equipment (PPE)
Chapter 16. Vehicle Mounted Elevating and Rotating Work Platforms, Manually Propelled and Self-Propelled Mobile Work Platforms, and Rolling (Mobile) Scaffolds (Towers)
Chapter 17. Scaffolding
Chapter 18. Machinery
Chapter 19. Emergency Shower and Eyewash Units
Chapter 20. Safety Color Coding, Labeling, and Marking For Piping Systems
Chapter 21. Hazardous Energy Control (Lockout and Tag Out) and Mishap Prevention Signs and Tags
Chapter 22. Flammables and Combustibles

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Organizational POCs	Name/Phone Number
Supervisor	
Flight Superintendent	
Squadron Commander	
Building Manager	
Unit Safety Manager	

Ensure emergency numbers are valid

Emergency Condition	Phone Number
Fire Department	
Ambulance	
Security Forces	
Wing Safety Office	
Military Public Health	
Hazardous Material Spill	
Bioenvironmental Engineering	

Your Building Number: _____

Building Street Address: _____

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